PERSONAL COMPUTER NEWS

THE COMPLETE COMPUTING WEEKLY

WEEK ENDING APRIL 22nd

35p

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Weigh the pros and cons of the Microframe and the IBM PC

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Pep up your Sinclair with hi-res on a tape

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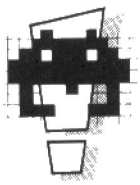

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Cover photography of Tycom Microframe by Ian McKinnell

Micropaedia Graphics Part 2
Second part in our series for six popular micros.

Any Advance on IBM?

A wave of IBM PC compatibles will flood into UK shops this summer.

The announcement of no fewer than six machines came last week claiming IBM compatibility at prices that will either make you laugh or cry.

Cheapest of the lot is the Advance 86a. It is a British-made micro costing a mere £399. For the money you will get a cassette-based machine with 128K random access memory, 16-colour graphics and an 84-key IBM-style keyboard.

A disk version of the machine, the 86b, will be available for £999. It will have twin 320K disks and MS/DOS as the operating system. The memory can be expanded up to a total of 768K.

Corona Data Systems will also be offering two models. The Corona PC and the Corona Portable PC were launched in the US last year at prices that undercut the IBM machine by about £900. At the time of going to press the UK prices were not available.

Top end of the price scale is the Hyperion from Gulfstream — this is the same system as the Ajile launched by Anderson Jacobson last week *(PCN April 15)*. Built by Dynalogic, it costs £2,900-plus. A re-run of the Sirius/Victor confrontation looks likely between Gulfstream and AJ.

It's based on the 8088 running MS/DOS with 256K RAM, two 320K 5¼in floppy disks and a built-in 7in amber screen. It's portable, having a tiny footprint, a canvas travelling bag and weighing in at Oh-minus-three pounds on the Osborne scale. They system has high resolution graphics and a battery backed-up real-time clock as standard.

Dynalogic has made some modifications to allow MS/DOS to be driven from the function keys, complete with on-line help and support for a RAM drive between 80K and 160K. A similar user interface extends into the Ajile's two bundled software packages, Multiplan and a text processor called In:scribe.

AJ hopes to support the machine in a similar manner to its terminals. The Ajile will be available for outright purchase or on company lease.

Corona's IBM-compatible portable — one of two micros awaited.

Advance Products is a company new to microcomputers, which may raise questions about its ability to supply machines in volume. With the prices it is quoting there will certainly be great demand.

Advance has kept down its costs by making use of Uncommitted Logic Arrays (ULAs) in the way Sinclair has done to reduce the number of components required. Neither micro comes with a built-in screen.

The machines make use of the 8086 chip, which runs marginally faster than the 8088 used in the IBM. They also have 16K of RAM committed to the video display, which offers resolutions up to 640 × 200 for graphics and 80 × 25 for text.

Interfaces on the 86a will be cassette port, light-pen, joystick and a centronics parallel port. In addition, the 86b will have a RS232C serial interface. It will also have four IBM-compatible expansion slots and what are described as two true 16-bit slots.

The company says that the micros will go into production in June or July.

Corona has yet to announce its UK distributors, and no date has been fixed for the launch of its machines.

Both micros feature 128K RAM, 640 × 325 graphics, a single 320K disk as standard and monochrome screen displays. Serial and parallel interfaces are provided, as are IBM compatible expansion slots. Memory can be expanded on the main board up to a total of 512K.

Cabel videos with knobs on

Cabel Electronic is hoping to put your micro properly in the picture.

Until now, Cabel's monitors have supported only RGB inputs, and their vertical hold and contrast controls could be altered only by taking them apart.

But the company plans to launch two new machines in May that will have recessed controls on the outside, and will be more versatile in operation.

The £200 basic model will still handle only RGB input, but the brightness, vertical hold and contrast will all be controlled from the outside. The £250 version will sport RGB and composite video input (PAL), as well as a colour and volume control.

The new models mark the beginning of Cabel's monitor production in this country. Until recently, all the monitors were produced in Italy, making it difficult to control quality and modify the equipment. But with its change to production in Wrexham, Cabel hopes to overcome those problems.

Although Cabel's existing monitor controls were placed inside the case of the machine to prevent people from unintentionally spoiling the display, the new controls will provide the same function by being recessed so that accidental adjustments will be unlikely.

Warranty promise as IoTech fails

IoTech, maker of the Iona business PC, is in the hands of the Receiver. But it is continuing to trade and will honour its warranties.

David Greetham, managing director, said: 'We are continuing to trade while the receivers examine our prospects further. They are making arrangements to make sure warranties are met.'

He continued: 'It's early days (the Receiver was appointed on April 8) but everything will be sorted out over the next eight weeks. Basically, we ran out of working capital.'

The company sells its own twin disk drives, software and colour printers for use on the £2,600 Iona, which runs CP/M.

On the trail of EOS . . .

Electronic Office Services (EOS), reputedly the biggest grey importer of IBM PCs in the UK, can now be found at Bridge House, 233-234 Blackfriars Road, London SE1, telephone 01-928 3377. But there is currently some mystery about EOS — *PCN* found it impossible to contract the company over several weeks.

PCN spoke to various dealers who have done business with EOS and found that they had had no contact with the firm for at least six weeks.

For all users of grey PCs, IBM UK is prepared to provide service as long as the parts of your machine are standard IBM. Work will be carried out on a time-and-materials basis, but if your components aren't standard, extra will be charged.

Amber set to honour its warranties

Don't tear up the warranty on your Amber 2400 printer yet — it could be valid after all.

On April 1 PCN reported that Amber Controls, the company which introduced the printer late last year, had gone into receivership on February 17, and that the on-year warranty on the machine might no longer be honoured.

Amber and its parent company — W Lethaby and Company — have been sold, but it looks as though the new owners will honour Amber's old warranties. Although Amber Controls no longer exists, Amber managing director Dave Rayner has stayed with the new Lethaby Numbering Systems Ltd.

And Mr Rayner said last month that if the company was sold and he was still in charge of the printer operation, he would make sure all warranties were honoured. Mr Rayner was unavailable for comment this week, but Lethaby officials confirmed that he still holds the reins on the Amber 2400 printer.

Any anxious Amber owners can get further details by contacting the company.

Verbatim plans floppy shop scheme

You may soon find it easy to buy floppy disks when and where you want them, and in flexible quantities, when a new disc retailing scheme gets under way.

Floppy disk maker Verbatim plans to move into high street electrical appliance shops in June. And if its pilot scheme succeeds you might be able to buy disks in the same way you now buy notepaper.

Verbatim has also unveiled its new floppy disk coating factory in Limerick, Ireland. This could bode well for the future availability of floppy disks.

Verbatim's 3½in floppy seems poised to make in impact with its portability and media durability, and Verbatim expects the hard-cased microfloppies to be made in Limerick within the next two years.

Structure is bonus in M-TEC package

You can now get a new, BBC-approved on CP/M systems, and the promise of structured programming is the bonus.

This new software package from M-TEC Software of Norwich is BBC Basic (Z80) for use on CP/M machines — it costs £95 plus VAT.

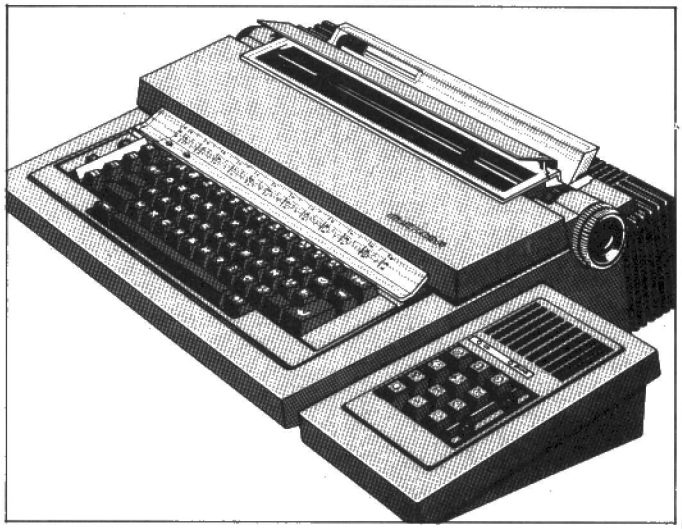
Unlike the popular M-Basic this version of BBC Basic is claimed to provide users with advanced features like long variable names, multi-line named functions and procedure which can have lacal variables. BBC Basic (Z80) also offers parameter passing and an in-line assembler.

File-handling commands are included so that, in addition to serial and random files, fully indexed and linked files with variable length records can be created and manipulated.

This version is only for use on a Z80 CPU running CP/M, whereas Acorn's version of BBC Basic will run only on machines using the 6502 processor. In its move towards structured programming it follows other producers of Basic interpreters — a trend is developing.

Grundy 8200 and Superbrain are just two examples of machines that will take the package, and M-TEC is currently talking to Torch, which hopes to be running this version on its machine by August.

You can now get the package direct from M-TEC Computer Services, telephone 0603-870620, or Software Limited, telephone 01-387 8832. Free updates are available for a year on both the program and the documentation.



HEAVY-DUTY PRAXIS — The Olivetti-manufactured Praxis has been a popular word processing companion to the Osborne I. It is a reasonably portable printer at a reasonably light-weight price. The latest in the Praxis range is the Praxis 41. Olivetti claims to have engineered a heavier duty cycle with no higher cost. Users can choose the interface (serial or parallel) and the printer/typwriter costs £495.

The Praxis can also be used as a stand-alone typewriter. It claims 100 printable characters, interchangeable daisywheels and 17 function keys. (The Practical Praxis, page 21.)

Epson deals launched

Epson has struck up a deal with two software houses, Peachtree and Pearl, to produce packages for the new QX10 micro.

The QX will cost £1,735 plus VAT and has the vital statistics of 192K RAM, 2×320K floppy disk drives, qwerty keyboard, monitor, three processors and CP/M as its operating system.

Steve Forster, an Epson dealer, said: 'The QX10 looks better value for money than its competitors — IBM PC and Sirius 1. And Peachtree and Pearl were chosen to supply software because Epson is concerned that their dealers are able to get good support for the system.'

The QX10 together with its software packages will be available from May 1 from Epson's 125 dealers and distributors.

CRA software saver

By David Guest

A scheme based to protect you if your software supplier goes out of business is expected to be adopted by the Computer Retailers Association (CRA) this week.

The CRA plans to hold source code copies of business software, so that if your supplier goes under the originals will be available. You will still have to pay for maintenance when you need it, but the idea is that you won't be left with an unserviceable relic.

The scheme has been approved in principle by the CRA's committee, and should be passed at a meeting on April 18.

CRA chairman Colin Stanley admitted that it had drawback, but he said that it represented a step in the right direction.

'The problem will be getting the suppliers to agree,' says Mr Stanley. 'Our canvassing of opinion among them has only been informal so far, but I think there should be no objection in principle as long as the source code is held by an independent body.'

The independent body is likely to be the CRA's solicitors. Other rules are to be built up around the execution of the plan — the essential condition is that the software supplier should have gone out of business.

The CRA itself includes such software houses as Pegasus and Tabs, and these companies will be among the first subscribers to the plan.

VIEW FROM AMERICA

Micros in line for memory expansion

From Chris Rowley

Wanted — enormously improved virtual memory system. Must be as cheap or cheaper than today's floppy disk. Must offer several megabytes in a small and convenient package that can be used in an ordinary human environment without the risk of damage and loss of data.

You might be forgiven for thinking this an unreasonable demand, except that there seems to be an avalanche of new hardware for virtual memory storage falling into place.

New micro chips like the Intel 80286 have appeared on the scene — and they can support a full gigabyte of virtual memory. New 16 and 32-bit microcomputers that will appear in the next few years will put the processing power of a mainframe computer into a micro.

And within 18 months to two years, such marvels as the Drexon Lasercard will appear. Two megabytes of ROM on a playing card area will be available for $10 or less!

By 1985, Toshiba plans to put out a micro floppy disk employing the new perpendicular magnetic recording technique, which will offer 50 megabytes or more of RAM for about $50 more than today's 400K floppy disk.

Before these perpendicular magnetic recorded disks become available, of course, the three inch micro floppy will have reached the market in great numbers. However, the first generation of micro floppies will be linear magnetic recordings, and despite improvements over the current 5¼in disk, they will hold at most 0.5 megabytes per side.

Similarly, there will be lower-priced Winchester hard disk systems appearing. But there are many who doubt the value of a hard disk system outside of the business environment, where smoke, pet hairs, even dandruff, can be kept to a minimum along with temperature changes, humidity and all the rest of the serious threats to hard disk systems.

What is becoming clear, though, is that enormous improvements in virtual memory are becoming essential for the complex new software now coming of age in such forms as the Apple Lisa operating system, and the Vision multiple application software promised by Visicorp for release this summer.

These new systems — while wonderful to contemplate — need a great deal of memory. Even with 256K RAM, it won't be possible to run Vision with more than a desk top management system and one applications program; hence the need for cheap new forms of virtual memory that can be quickly accessed by microcomputers.

Which is why there are so many Japanese companies working hard on perfecting perpendicular magnetic recording. This will end the old problem of squeezing thousands of tiny magnets in linear arrangement onto a disk, each magnet representing a single bit of information. The problem of magnets demagnetising themselves puts an absolute limit on the memory storage potential of the linear method.

But with perpendicular magnetic recording, the tiny magnets are created in a forest of crystals standing out of the disk surface. They can be squeezed together much more tightly, and thus achieve five to 10 times as much memory storage capacity.

Even better, the new PMR floppy disks will be only 50% or more expensive than the current types, thus continuing the trend towards cheaper memory per byte.

However, while PMR offers a tremendous improvement in read and write memory capacity, the advances in laser disks and cards are opening up new vistas for software creators. Drexler Corporation's laser cards are now starting to enter the US market and they promise a dramatic lowering of software costs.

Sirius gets 512K

Gerry O'Prey — expanding business

To boost the capacity of your Sirius, Intelligence Research has produced a RAM board capable of storing 512K.

According to Sirius' UK distributor ACT, the largest add-on available until now for the Sirius was its own 384K board. 'We've managed to squeeze on 512K', said Gerry O'Prey, managing director of Intelligence Research. 'And with it we provide free software to allow it to appear to the system as a pseudo-disk.'

Volume quantities of the board should be coming off the production lines in a week's time. It will be sold through dealers, and the one-off price to a dealer is £190.

Intelligence Research already sells a 256K board for the Sirius, but the new product gives it a range to offer. The minimum configuration is 128K, and plug-in extra chips build it up to 512K.

The company recently introduced boards for the IBM PC and Apple systems. For the IBM PC it has a 64K board upgradable to 512K and a multifunction board with a communications adaptor, a parallel printer port, clock/calendar, software for a pseudo disk, and a printer buffer.

In the Apple line it produces RAM boards up to 256K for the Apple II, and screen conversion boards for the IIe.

Intelligence Research is an offshoot of Intelligence UK, which produced the modelling software Micromodeller.

Xerox copies Apple on US Easter price cuts

Hot on the heels of Apple, Xerox became the second PC computer giant to cut its US prices the week after Easter.

Its Model 820 dropped 26% from $2,445 to $1,795, while the Apple III's price for the 256K model fell from $3,495 to $2,695. The 128K Apple III dropped from $2,995 to $2,495, and Apple announced that it would be discontinuing this version.

An Apple spokeswoman said: 'We are not in a position to comment on why prices have been cut and we cannot say whether our UK prices will follow suit.'

On the subject of possible UK price cuts, a Xerox spokesman said: 'Prices aren't being cut here on any of our models and as far as I know there are no plans to do so.'

A US price war need not affect the UK, as earlier sparring has shown.

Database on Televideo

A database management system for Televideo users is now available from software firm Midlectron.

It has just launched a new DBMS for the Televideo range. Called TeleDBMS, it is basically the CP/M system, Optimum, adapted to work with Televideo's single user and networking systems. It costs £529.

TeleDBMS lets you create your own menus, data entry and display forms, output formats and customised reports.

It also takes advantage of Televideo's hardware features, with the result that many commands require only one keystroke.

A new Star in the firmament

Micropro has added a new database manager to its range of CP/M software packages.

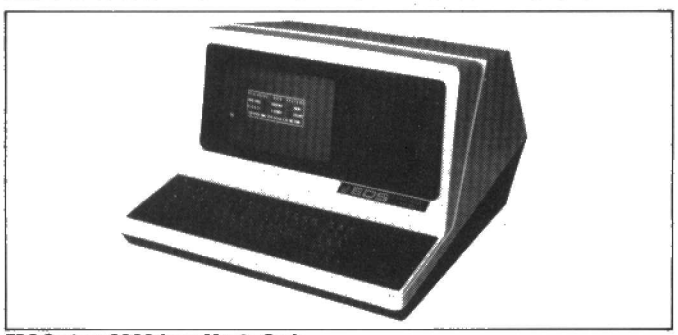
The new Star that joins Micropro's constellation is called Infostar — there is still no sign of StarStar. Micropro describes it as a file processor and business report generator.

InfoStar combines the features of two other Micropro products, Datastar and ReportStar for the price of £300.

Micropro says that experienced users will get the most out of InfoStar, but adds that non-programmers can use it through an on-screen menu and a simple forms production routine.

According to Micropro the package also includes a selection of report qualities, a sort that can handle 560 records a minute, and hooks into other Micropro products such as WordStar.

Encotel's EDS for business



EDS System 2000 from Monte Carlo.

New business computers have reached the UK from Monte Carlo.

The EDS range of machines runs the souped-up CP/M-compatible TurboDOS operating system.

The EDS 1016 and 1516 dual processor models can run both 8 and 16-bit software, and disk storage ranges from 720K on floppy to 10Mb on a Winchester.

The 1516 costs around £2,716 plus VAT, while the 1016 is about £3,521 plus VAT.

The 1850 model has 50Mb of disk storage, uses a Z80A and an optional Intel 80186 processor chip — claimed to be twice the speed of the 8086. This model is available as an 8-bit system or in a 16-bit dual processor version and costs about £6,000.

All three can be networked together, so the range provides stand alone and multi-user capacity, and runs CP/M programs on TurboDOS.

Encotel Systems of Croydon is sole EDS distributor.

PCN Charts

PCN Charts follows the rise and fall of the UK's best-selling micros. This fortnightly top-of-the-shops list tells you what's selling best over the counter; it does not take account of mail order and does not count deposit-only orders. This week's figures show the number of machines sold in the two-weeks period ending two weeks before publication date (in this case April 15), so these charts tell the story in high streets between March 18 and April 1.

Machine prices quoted are for the no-frills models and include VAT. Information for the PCN Charts is culled from retailers and dealers throughout the country and compiled by MRIB, London. They will be updated every alternate week . . . so watch for the arrows to follow the ups and downs of the best-sellers.

Top Twenty up to £1,000

		MODEL	PRICE	DISTRIBUTOR
▲	1 (3)	Sinclair Spectrum	£125	(SI)
▶	2 (2)	Sinclair ZX81	£50	(SI)
▼	3 (1)	BBC Model B	£399	(AC)
▲	4 (7)	Dragon 32	£200	(DR)
▲	5 (6)	Commodore Vic-20	£170	(CO)
▲	6 (9)	Oric 1	£100	(OR)
▲	7 (17)	Lynx 48	£225	(CA)
▼	8 (4)	Atari 400	£160	(AT)
▲	9 (14)	Sharp PC 1500	£170	(SH)
▲	10 (11)	Commodore 64	£345	(CO)
▼	11 (10)	Atari 800	£400	(AT)
▲	12 (15)	Texas TI99	£150	(TE)
▼	13 (5)	Newbrain A	£228	(GR)
▼	14 (12)	Acorn Atom	£174	(AC)
	15 (—)	Sharp PC 1251	£80	(SH)
▼	16 (8)	Jupiter Ace	£90	(JU)
▼	17 (13)	Apple II	£776	(AP)
▶	18 (18)	Colour Genie	£224	(LO)
▼	19 (16)	Epson HX20	£472	(EP)
▼	20 (19)	Tandy TRS (C/C)	£240	(TA)

Top Ten over £1,000

▶	1 (1)	Sirius 1	£2,754	(SI)
▶	2 (2)	Osborne 1	£1,581	(OS)
▶	3 (3)	Olivetti M20	£2,754	(OL)
▲	4 (6)	Commodore 8032	£1,029	(CO)
▼	5 (4)	HP 86A	£1,541	(HP)
	6 (—)	IBM PC	£2,392	(KG)
▶	7 (7)	Sanyo MBC 1000	£1,195	(SA)
▶	8 (8)	Micro-Mimi 803	£1,720	(BM)
▼	9 (5)	Apple III	£2,780	(AP)
▶	10 (10)	Xerox 820	£2,415	(RX)

AC Acorn Computers. **ACT** — ACT Sirius. **AP** — Apple Computers. **AT** — Atari International. **BM** — British Micro. **CA** — Camputers. **CO** — Commodore. **DR** — Dragon Data. **EP** — Epson. **GR** — Grundy Business. **HP** — Hewlett-Packard. **IC** — Icarus Computers. **KG** — KGB Micros. **LO** — Lowe Electronics. **MM** — Micro Marketing. **OL** — Olivetti. **OR** — Oric. **OS** — Osborne Computers Corporation. **RX** — Rank Xerox. **SA** — Sanyo Marubeni. **SH** — Sharp. **SI** — Sinclair. **TA** — Tandy. **TE** — Texas Instruments.

17,000 rush to Micronet

As Micronet becomes available to more machines the system's organisers have found themselves inundated with applications to join.

Since its launch (*PCN, March 18*) Micronet has received 17,000 applications to join and it is still catching up on a backlog of 2,000 BBC users, as well as processing applications from owners of other micros now eligible to join.

From the beginning of April users of the Commodore Pet, TRS 80 and RML micros have been able to hook up to Micronet and download 100 free programs, providing, of course, they have the terminal hardware and software.

Prices vary according to the machine you own. TRS80 Model I and II owners can join for £60.95 and RML380Z users for £63.40. The price for Commodore Pet owners varies from £81.65 to £93.15, depending on the model.

It costs more for the Commodore Pet because Micronet has had to develop a special interface that includes a graphics chip and a serial port.

Micronet's organiser plans to continue adding other micros to the system. The next in line is the Apple, whose free software pages went on Micronet this week. The interface and software for the Apple costs £70.15.

A modem is being developed by Prism MicroProducts for the system. It will not only give access to Prestel but will also allow micro-to-micro communications.

● You can now talk back to PCN on Micronet: go to page 6006015.

Genie owners join the club

Users of the Lowe Colour Genie will be able to join kindred spirits in the newly formed National Colour Genie Users' Club from April 16.

For £10 a year you'll get a bi-monthly magazine, access to a software library, and free technical help.

Lowe Computers is financing the club initially but intends the group to become self-financing — and therefore independent — as it grows.

This will be Lowe's first experience of a user group formed nationally.

Get it taped

Companies are queuing up to provide facilities that could set you on the road to software stardom.

In the south of England Direct Media Facilities (DMF) has set up a new division to help software authors develop a marketable product. And in the north, Spool Duplication has geared itself up to turn out 25,000 tapes a month.

DMF has extended the set-up that handles the bulk of its work in audio, audiovisual and video production to include cassette copying and the design of inlay cards.

'We'll deal with anyone who gives us a call,' said DMF production control manager Mark Andrews. He explained that the service would consist of providing graphics design and cassette duplication for authors with a piece of software to sell.

Marketing manager Mike Phinn described it as a natural development for the company, and added that the service should leave programmers with more time to concentrate on programming.

To forestall any legal problems, DFM will ask anybody using the service to sign a statement accepting responsibility for the copies produced.

Spool Duplication's background is in digital computer cassette reproduction and audio work. Technical director Roy Varley said that its new service would aim for top quality tapes at a realistic price. 'We expect to be able to keep the price per thousand around 36p per take,' he said.

Spool is aiming its service mainly at software houses, but DMF will accept individuals as well — its move was prompted by inquiries from individual programmers.

DMF is in Waterlooville, Hampshire on 07014 66337. Spool is on 0244 313778.

How to beat the burglars

One way of discouraging the burglars is to create the impression you are at home by switching lights and the TV on and off automatically.

Centec Electronic Systems has just brought out a little box that enables your micro to do this job for you.

The mains switching unit comes in three versions that can control one, two or four mains devices.

They cost £19.95, £29.95 and £49.95 respectively.

The unit needs its own 12 volt power supply, which Centec can provide for an additional £6.95. Centec is on Orpington 35353.

Micro cures?

Thousands of GLC workers will soon be able to diagnose their own ailments with the help of Medibank, a software package designed by Paul Membrey.

Mr Membrey, an architect with the GLC housing department at County Hall, says that Medibank is not a substitute for a doctor's diagnosis but a useful guide to a known symptom or symptoms.

He said: 'Through simple yes or no answers a preliminary diagnosis can be made quickly. For example if you have a sore throat, you call up the symptom on the appropriate page, and you are then asked a series of questions.

'For instance is your temperature 38°C or above? Do you have swellings or tenderness in your neck? Do you have a stuffy or runny nose? Or have you been sneezing? If your answer to all these questions is no, except the last one, you have a cold. In all, 99 symptoms are listed.'

It took Mr Membrey six months to write the medical program on his BBC machine. And in total he has six disks with 325K of information.

Mr Membrey says that so far the response from the appropriate heads in the GLC has been good. And within two weeks he hopes to have Medibank installed on the GLC's mainframe computer.

With 500 terminals linked to the mainframe and the possibility of 23,000 employees being able to diagnose their illness, it could save a lot of trips to the doctor.

Mr Membrey says that medical people working in the GLC have also shown an interest in his package. He said: 'They will be looking at it with the possibility of expanding it for their own use. But there's no intention of storing data.'

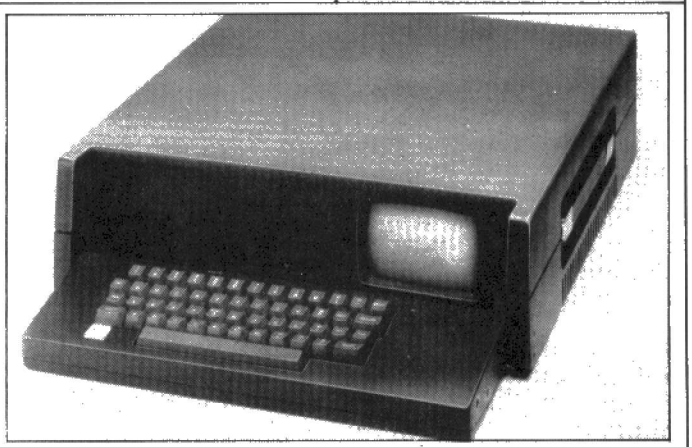
Grappler interface for Apple

Apple users will soon be able to grapple with a device billed as 'The most intelligent Apple interface'.

It's the latest in the Grappler range from Orange Micro and it includes an expandable printer memory.

The Buffered Grappler is compatible with the Apple II, II+, IIe and III computers and its standard 16K buffer is upgradable to 32K or 64K by the addition of memory chips.

The interface itself is claimed to be compatible with most popular dot-matrix printers including Epson, Okidata and Anadex and is configured by a simple dip switch setting. The device is due to come on the market here in May, and will cost around £160 depending on the exchange rate. It will be available from Pete and Pam Computers, telephone 0706 227011.



The Merlin is intended for the more hostile environment.

Merlin micro is dustproof

For those of you who need a micro that can take a few knocks, Xcalibur Computers has launched the Merlin.

The Merlin is cased in a chemical resistant foam material and weighs 25lbs. Its vital statistics are 445 × 470 × 130mm.

With an Apple II+ motherboard inside it, it comes with a 5in black and white monitor and a fold-away qwerty keyboard, priced £1,075 plus VAT. The same configuration with an Apple IIe motherboard costs £1,245 plus VAT.

Other options which can be fitted include a single disk drive, Eprom system or bubble memory. You can also buy the Merlin box on its own for £150.

Xcalibur Computers sees its micro being used in hospitals, laboratories and industrial areas — where computers are not normally used because of a harsh environment or lack of room.

Jeff Barringer, managing director of Xcalibur, said: 'Basically it's for the laboratory or industrial manager who uses an Apple in his office, but would like to put it out in the industrial environment for control purposes.'

The Merlin has been designed to be compatible with a variety of microcomputer motherboards, and Xcalibur will consider requests to meet specific requirements.

The Merlin computer will be available at the end of April from Xcalibur Computers, telephone Northampton (0604) 21051.

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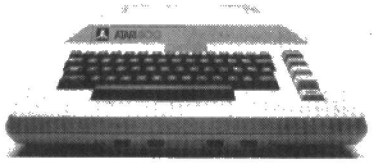

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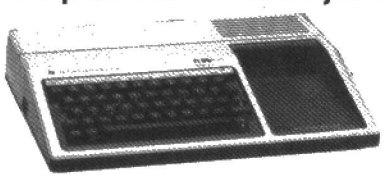

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Business Tabs

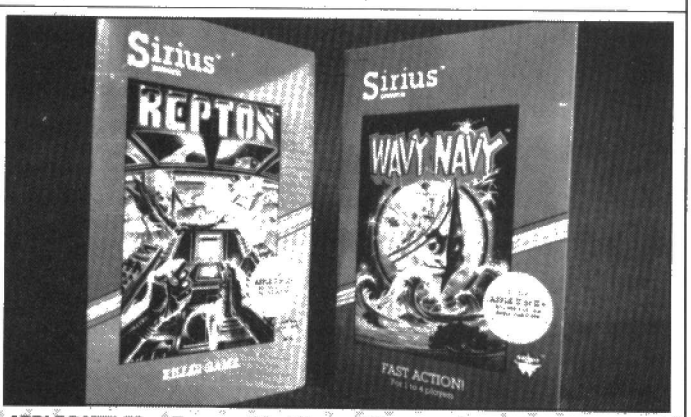
A full business package for those preparing to take the plunge into computerisation is on offer from Andover software house TABS.

TABS has scaled down its accounting and business software to run on Sirius or IBM PCs under the name of Easy-Tabs. It will supply the hardware, peripherals, software, documentation and support.

You can buy the EasyTabs range of programs individually for £99 each plus VAT. They cover sales ledger, purchase ledger, cash book, a mail list, and word processing. The price includes a 12-month warranty, and the disk-based packages are now available from TABS dealers. All five packages can be run separately or together and the idea is to show the businessman/woman all they need to know to computerise a small business.

Gillian Bissland, marketing assistant at TABS said: 'At present, the packages run on Sirius and the IBM PC and will soon be available for use on the CP/M operating system and the Apple IIe — possibly the BBC micro, too.'

The company says that if the user's business grows, it would be simple to upgrade your system to use the standard TABS range. Telephone 0264-58933 for more information from TABS.



APPLE BATTLES — Two new 'blast them off the screen' games for the Apple are available on disk from Pete & Pam Computers. Repton costs £28.70 and has you commanding a star fighter trying to defend your home planet against the invading Quarriors. You have in your armoury laser guns, nuke bombs and energy shields. The nasties have nova cruisers, single saucers, spy satellites, dyne-beam shooters and draynes. Wavy Navy costs £32.15 and puts you at the joystick (sorry, helm) of a PT boat taking on a squadron of enemy bombers, kamikaze fighters and 30ft waves in an ocean filled with mines. There are ten levels of difficulty. You start off as a galley slave and could end up as President of the United States. Pete & Pam is on 0706-227011.

£20 megabyte

Storage at £15 to £20 a megabyte is one of the promises Sintrom makes for the range of 5¼in Winchester disks it has just brought to the UK.

The CM6000 Series comes from US company Computer Memories — the disks will appear in OEM systems and in the mircos produced by Sintrom's sister company Perex. Perex will also offer them as back-up devices to the Apple III's Profile disk.

The three models in the series are the single-platter CM6613 with 13Mb, the two-platter CM6626 with 26Mb, and the three-platter CM6640 with 40Mb. Data transfer rate is 5 megabits per sec.

Sintrom Electronics is on Reading (0734) 875464.

Acorn in the garden

BBC users who don't know the difference between a pansy and a petunia may find a new program from Acornsoft extremely useful.

Called The Magic Garden, it is aimed at people who lack green fingers. All you have to do is tap into your BBC micro the colour and size of plant and where you want to put it in the garden. The program then produces a list of suitable plants.

The program will cost about £10 on cassette and is due out in mid-May.

It is being launched in conjunction with the book of the same name written by Shirley Conran, who has co-operated with the design of the software.

Micro capacity leaps

The rivalry between US and Japanese semiconductor makers is spawning a bumper crop of powerful devices that could be a big bonus for micro users.

Processor chips are moving towards 32-bit processing in production micros, and storage chips are growing in capacity towards 'infinite' potential. All in all, the next 12 months could see a massive jump in the capability of the micros on the market.

Motorola, Intel and National Semiconductor are all working on 32-bit processors of the kind that give increased addressing power and speed.

Nat Semi has come out with the NS16000 family of VLSI processors. These are capable of handling 16 megabytes of virtual memory, and run at 6MHz at the moment, but will be upgraded to 12 and 14MHz next year.

From Intel the 80286 is following hard on the heels of the iAPX 80186; it can address no less than one gigabyte of virtual memory. Motorola's NC6800 aims to occupy a similar niche.

Motorola has also brought out a 64-bit bi-polar RAM chip, the NC10H145, which has a three nanosecond access time. But the biggest advances in memory technology are being claimed by companies on the other side of the Pacific.

Nippon Electric (NEC) last week announced that it has developed a new technique to expand the capacity of memory devices dramatically.

Called Bloch Line Memory, the technique allows a one square centimetre chip to store one billion bits. Koichi Yoshimi, of NEC's research laboratory, said the possible uses of such a memory are 'infinite'. He added that the chip would sit outside a computer and data would be safe if the system's power supply was switched off.

The NEC researcher said that his company has no immediate plans for mass-production of Bloch Line Memories, but the Japanese are not renowned for wasting time.

Tally printers out by May

Two new printers from Mannesmann Tally will be on sale by May, if not sooner.

The MT160 and MT180 printers, priced at £599 and £799 plus VAT, are aimed at small businesses. They can be used on practically any micro, as they have built-in parallel and serial interfaces.

They can fit in with data and word processing systems and are said to be robustly made with very high quality print.

Both printers will be available nationwide through small High Street retail outlets, and will be distributed by MT Direct, which is a new division of Mannesmann Tally, located at the Wokingham headquarters.

MT Direct can be contacted on 0734-788711.

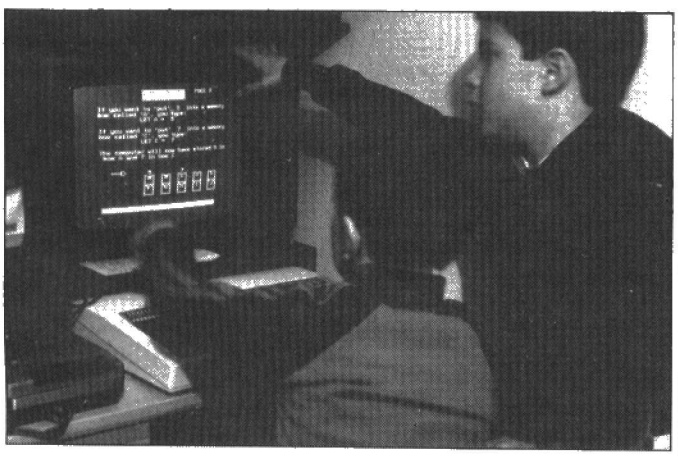
Commodore's business end

Attention newsagents and engineers — The Computer Room has produced two packages for you that will run on Commodore hardware.

Epic (Engineers Production Control System) is designed for the Commodore 8000 with a hard disk. It is a suite of programs intended for production control in small to medium manufacturing companies.

Supernews is based on the Commodore 64, and sells as a complete package for £1,500 excluding VAT. It handles newspaper delivery organisation and accounting, the Computer Room says.

The Computer Room is on Tonbridge (0732) 355962.



CARDS FOR KIDS — After recipe cards and gardening cards come programming cards (no relation to our own ProgramCards), designed by Edu-Cal to make life easier for schoolkids. The company has produced a set of cards, called 'Programming Made Easy', to spare young programmers the trouble of leafing through books and manuals. The language of the cards is said by Edu-Cal to be a blend of computer terminology and the kind of speech children use. The set, which comes with a checklist to monitor progress, costs £8.90 plus 60p postage and packing from Edu-Cal, 28 Ingersoll Rd, Shepherds Bush, London W12 7BD, tel 01-743 1579.

BASF disk promise of a lifetime

A promise to replace a floppy disk if it goes wrong must be worth something. Perhaps that is why Pete & Pam Computers have started to sell the Qualimetric Flexy disks from BASF.

BASF is so confident about the high standard of quality of these disks that it is offering a lifetime warranty.

The jacket of the Flexy disk features a special two piece liner.

This is said to trap damaging debris away from the disk surface, and to create extra space in the head access area to ensure optimum media-to-head alignment.

A box of ten 5¼in single-sided, single-density disks costs £20.60, and Pete and Pam can be contacted on 0706-227011.

Apple pie-in-sky from USA

Desk-bound pilots among you may be interested to hear that three new flight simulation systems have arrived from the US.

Airsim-1, Spitfire Simulator and Cleared to Land are being sold in the UK by Beattie-Edwards Aviation. All run on Apple equipment — the Spitfire Simulator on the Apple II Plus, and the others on a standard Apple II with at least 48K of RAM.

Airsim-1 puts you in command of an aircraft over the New England coastline. You have the appropriate instruments, and a plane whose movements are governed by the equations that apply to the real thing. It costs £39 plus VAT.

Spitfire Simulator is for the more belligerent, with a Battle of Britain backcloth and targets that will be familiar to all builders of Airfix kits. It also costs £39.

Cleared to Land is the most expensive of the trio, at £44.85 plus VAT.

Beattie-Edwards Aviation can be contacted on Crawley (0293) 20565 or direct at Biggin Hill.

Random Access is *PCN*'s forum for readers with a point of view to express.

Letters come from people like you, so pull out your INKEY finger and feed us a line. If it's of star quality *PCN* will add £10 to your spreadsheet.

Address us at Random Access, *Personal Computer News*, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

Programming gains from gaming

D T Hartley (*PCN April 8*) agrees with Martin Banks in that micros are used 'to fire pretend rockets at pretend invaders from pretend space' and asks: 'Couldn't all that power be put to much better use?'

What a silly question; it can and is being put to 'better use'. But how does one learn to write a word processing package? One writes games — which are infinitely easier to write, and then the experience gained by writing games can be put to 'better use'.

And the people who buy games (I am not among them) are at least bashing 'pretend invaders' and not other people. With full employment now impractical, games could help keep the world habitable.

Andrew Mulholland,
Sherwood, Nottingham

PS On the page opposite Hartley's letter is an advert saying 'for the Unexpected Vic-20'. This conjures up visions of: 'Mum, I am afraid I am going to have a Vic-20.' A gunshot interface. As the computer expands, all its peripherals have to be bought second-hand, the social stigma . . . I could go on.

Open your eyes to young talent

May I take this opportunity to congratulate Mr J R Mortleman on his letter in *PCN*, April 8. If R J Parsons kept his eyes and ears open a little more, he would see that in many cases the capabilities of young people to program micros far exceeds that of the older generation.

Take Jeremy Ruston for instance. At 17, he is the author of books such as *Pascal for Human Beings* and *The BBC Micro Revealed*, currently number one in the Micro Book charts. Along with Tim Hartnell, he has written *The Book of Listings*, which, as a Beeb user, I praise highly. Eugene Evans, author of games such as Frantic, Wacky Waiters and Catcha Snatcha is aged only 16.

May I suggest that Mr Parsons stops criticising young people because of their vandal-like stereotype, and acknowledges their skills. You never know, he might learn something!

D T Machin,
Longton, Stoke-on-Trent

Buyer's blues

I ask myself, do I have dandruff, do I have BO or do I have leprosy? No, I simply bought my BBC micro from the BBC rather than from the Acorn dealer network.

At the time I ordered my BBC micro I felt pleased to be supporting a first-rate British New Project. What is more, I wasn't alone. Thousands of us were prepared to put our money on the line even after months of delays.

Now we find we might just as well have the above named conditions and the reason for this case of hypochondria is as follows.

On occasion without number I am told by Acorn dealers that because of limited stock availability they can only supply certain items to people who bought their machines from them.

Now, while I can understand this from the dealer's point of view, it means that the very people who got the project off the ground and helped make it successful are now being penalised for it.

To add insult to injury, I notice *(PCN, Monitor, March 25)* that Sinclair is to offer microdrives preferentially to those who purchased their Spectrums by mail order.

Why is it that Acorn cannot do something along these lines for their mail order customers when it comes to upgrading such things as power supplies and recently the 1.2 MOS?

John C Neal
Ilford, Essex

In defence of the Colour Genie

There has been a lot of controversy over the Colour Genie vs Dragon 32 affair. Many of the reviews in magazines give false information about the Genie's capabilities. For instance, many, if not all these reviews, say that the Genie has eight colours and the Dragon has nine. This is untrue, as the Genie has 16 colours.

May I also point out that the sound on the Genie is of a much more useful nature than the Dragon's, as the programmable sound generator couples with the three channels and eight octaves to make a sound that, to quote one review, 'is comparable with the BBC micro'.

Many people also think that the Dragon's graphics are better than the Genie's. Admittedly, the graphic commands on the Dragon are comprehensive, but to the point of absurdity, whereas the Genie has straightforward, easy to use and flexible graphics commands.

With reference to Mr R J Parsons' letter on games that was published recently, I agree with J R Mortleman's comments. I am 12 years old and have a Colour Genie, and 75% of my time is spent writing programs other than games. I hope Mr Parsons will realise, if he reads this letter, that not all young users are 'sticky-fingered, bug-eyed games addicts'.

I think that *PCN* is great, but how about some Colour Genie Programs? Your 35p price tag is much appreciated, as pocket money is limited.

Anthony Asquith,
Lytham, Lancs

Free the Threebies

Do you have to put things like Threebies and competition forms on the back of articles, hence ruining these articles? Why not on the back of adverts instead? I did intend filing Keith Bowden's 'Simon's Not So Simple' article, but alas it is not to be. No one in their right mind passes up the chance of a free (?) BBC B.

I thoroughly agree with Mona Cundick *(PCN, March 25,)* that there is a definite need to try toget UK microcomputer prices in line with USA prices. Also, I agree with P Grumann *(PCN, April 1)* on sticking up for the 'Micro-Brotherhood'. But does he not think that friendly rivalry stimulates the market and leads to better quality hard and software? And surely we all like to think we've bought the best now and again

Finally, I have a question. With firms rushing to undercut Sinclair and every aspect of his computers' peripherals and software, why has someone not produced an upgrade for the BBC A substantially cheaper than £95? Is anyone interested?

Antony Sherman,
West Bridgford, Nottingham

Good service from Grundy

I would like to break with convention and offer some praise to a British company — Grundy Business Systems.

I am a nurse tutor who over the past two years has become more and more interested in the use of computers in nurse education — that is, computer assisted learning.

After much thought and research I purchased a Newbrain computer to learn about computing and to 'try may hand' at writing educational software. I have been delighted with my purchase and it has lived up to all my hopes and expectations.

Perhaps even more important to a novice such as myself, working in an impecunious organisation such as the NHS, is the support offered to the consumer. In this respect, no company could possibly have been more helpful, constructive, and indeed generous than Grundy Business Systems.

Well done Grundy and good luck for the future.

P I Pleasance,
South Lincolnshire School of Nursing
Boston, Lincs

Buy locally

I would like to give some advice to prospective computer buyers with £100-£500 to spend.

It is much better to buy from the local high street computer shops rather than buying from a manufacturer. This way you get a personal service and a chance to try the machine you are interested in. This is better than listening to an uninformative answer phone.

By buying from a dealer you get the machine directly rather than having to wait for 28 days' plus. I speak from experience as I ordered an Oric1 over a month ago, and then found out I was not likely to receive it for four months.

Ian Fereday,
Barmouth, Gwynedd,
North Wales

ROUTINE INQUIRIES

Max 'B DOS ERROR ON A' Phillips opens the pod door, Hal. Got a query? Send it here. No personal replies promised but you never know . . .

Write to: Max Phillips, Routine Inquiries, Personal Computer News, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

Vic joins the character set

I am 13 and own a Vic-20 personal computer. Can you tell me how to make my own characters? I know how to use CHR$ but it only works for normal characters.
Jason Sprott,
Edinburgh

The best place for this, and all sorts of other useful information, is the Vic-20 Programmer's reference guide. Get a copy if you can.

As you've guessed, Commodore doesn't make user defined graphics easy. The Vic chip uses a pointer in location 36869 to tell it where to get its characters from. This is normally an area of ROM that contains the Vic's standard character set. To use your own characters, you need to:

- Prevent Basic from overwriting an area of RAM.
- Copy any of the standard characters you want (A...Z ,0...9 and so on) from ROM into your bit of RAM.
- Poke in any new characters of your own design into your area of RAM.
- Alter 36869 to point to the new character set.

Sounds awful? Let's try a simple example of what can be done. Steal some of Basic's memory from location 7168 onwards with POKE 52,28: POKE 56,28:CLR. Now copy the standard character set from ROM to your bit of RAM:

```
FOR I= 7168 TO 7679:POKE
  I,PEEK(I+25600):NEXT.
```

Finally, tell the Vic chip to use your RAM based character set. POKE 36869,255.

If all goes well, you should see no change. The Vic is using an identical copy of its normal character set. But now it's in RAM, so you can POKE new character shapes into it.

Each character is formed from a set of eight 8-bit bytes. Where a 1 occurs in one of the bytes, a dot appears on the screen, where there's a zero, no dots appear. The first thing to do is draw your own character on an 8×8 grid. Then convert the shaded squares to 1s and the blank squares to 0s. This gives you eight binary numbers. Here's my rather sad attempt at a space invader:

```
00111100
01111110
01011010
01111110
00111100
00100100
01100110
00000000
```

Convert the bytes, from the top down, into decimal numbers. This is easiest by writing the headings 128 64 32 16 8 4 2 1 above each of the columns. For each byte, add together the column headings with 1s underneath. The harmless space invader becomes 60, 126, 90,126,60,36,102,0. Now all you have to do is POKE the new character over the top of one of the existing ones.

To change a particular character, POKE the definition starting from address 7168+8* the relevant screen code. The exclamation mark has screen code 33. So get the space invader, try the following program:

```
10 FOR I=7432 to 7439:READ
   B:POKE I,B: NEXT
20 DATA
   60,126,90,126,60,36,102,0
```

If you're lucky, the ! symbol will have changed to a space invader. That's only a quick summary of what has to be done. There are lots of ways of doing it and lots more things can be done. So it's worth experimenting or getting hold of the Programmer's reference guide.

Can micros use hi-fi decks?

Is it possible to use the cassette deck in my hi-fi system with the BBC micro I intend to buy? What leads should I use?
Neil Mackay,
Halkirk, Caithness

The answer is a resounding maybe. Most people use cheap recorders with their computer systems because expensive hi-fi systems tend to mess the signal round so much it is unintelligible to the computer. But if you switch off filters, Dolbys and so on it might work. It may still be worth your while buying a cheap recorder, as it lets you keep the micro set up and saves you messing around with leads and switches.

Whatever you use, you'll need to have a lead made up as appropriate. If you can't do it yourself, your BBC dealer and probably local Tandy or electrical store will do it for you. At the BBC end, you need a 7 pin DIN, and at the other end, you need plugs appropriate for the recorder. MIC and EAR will be either separate jacks or part of a 5 pin DIN plugged into a REC/PLAY socket.

You don't need remote control with the BBC, though its nice to have. It is usually a separate miniature jack connected to a socket marked REM or Remote. If you don't want remote control, then you can get away with a 5 pin DIN at the BBC end. Once you've got the system working, label the leads and mark the controls in place.

Teething troubles with the 16K Oric

I own a ZX81 and I feel I want to go up to a more sophisticated machine. I am still at school and my part time job doesn't bring a lot of money in. I thought of getting a 16K Oric 1 but I was told that Oric had stopped producing this type of machine. Is this true? and is there much software available for the Oric?
Andrew Cannon,
Three Bridges, Crawley

Oric has yet to get round to delivering a 16K Oric 1, as the company has had problems with memory chips. It still intends to produce a 16K machine but says that its price might be 'slightly higher'. This will no doubt upset all those who have ordered the £99 machine Oric advertised.

There's not a lot of software available yet for any Oric model. Bugs in the Basic have made it hard for the usual rush of Basic programs to be flung onto the market, while Oric itself is presumably too occupied curing the bugs to be working on applications software.

So it might be worth waiting to see what happens with the Oric scene. It's a great machine, but it's still got a few teething problems. Being a ZX81 owner, you'll appreciate Sinclair design. If you can afford it, go for a Spectrum. At least you can walk into a shop and buy one along with a handful of tapes, which is more than you can say for many of the newer machines.

Graphics and text applied to Apples

On an Apple II/ITT 2020, is it possible to mix text and high resolution graphics without recourse to shape table? Can you print text on low resolution graphics?

How do you print text on text page 2?
David Smith,
Chester

There are lots of ways that have been developed to mix hi-resolution and text. The most effective is to use a software character generator, which draws the individual characters shapes on the screen as you print them.

Programs to do this get very sophisticated, but the Apple users had user-definable characters this way before it was standard on many machines.

Another trick you will see is that the programs can generate tiny characters, allowing up to about 70 characters a line without any special hardware.

Wander down to your Apple dealer and have a look at what's available.

The other way of mixing the two is to swap over the text screen and graphics screen at the right speed, giving the illusion of superimposed text. It sounds far-fetched, but try the Applevision demo program on a 3.3 master disk.

It might be possible to put text on page 1 and low resolution graphics on page two, and alternate them in this way. It is the only way you could mix the two.

But I can't think of an application that would make it worth the trouble.

The Apple doesn't have an immediate way of printing on text page 2.

But you can write your own machine code output routine to do this, or better still just copy the ROM routine into RAM and change it. The other way is to write text to page 1 and then copy page 1 memory to page 2.

A short machine code routine is best for this as well. Remember that if you are using text page 2 from an Applesoft Basic program, you'll need to move LOMEM upwards.

Further information can be had from the Apple II reference manual or the Applesoft manual.

Problem: How to run MS-DOS and CP/M 86 programs on the IBM PC? Deenagh Brook reports.

Two-handed conversion for the IBM

By the time you've finished trying to convert existing MS-DOS (Microsoft DOS) or CP/M 86 programs to run on the IBM PC, you might end up calling it an irritating breed of machine.

There are two big problems. The first has to do with the IBM's unusual interrupt-driven screen handling, and the second with the way IBM's PC Basic protects programs.

To understand the first problem, you have to take into account the history of personal computers. The VDUs on most micros behave like the teletype machines they evolved from, while cursor addressing is handled by ASCII characters. But the IBM's cursor handling is interrupt driven, which means that assembler routines in PC Basic handle screen addressing.

If you're programming from scratch, screen handling is made easy by this assembler routine system — but when converting existing programs this feature is a headache.

Screen-handling

It's a big enough headache for software houses to have already plunged in to solve the problem. Compact Accounting Services approached the conversion by tackling the screen-handling problem first.

The company has developed a large integrated accounting system that successfully runs on 65 micros and has a control program in which all the escape codes for the screen are set. But on the PC, where there is no need for such codes, a different version of the package was written and compiled — immediately requiring that two source codes be maintained.

Because of the differences between Basic under MS-DOS and PC-DOS and the fact that operating systems are available only from original equipment manufacturers, you might find yourself missing some of the original MS-Basic, such as the WIDTH statement. The omission occurs because you are unlikely to get the extended MS-Basic from the original equipment manufacturers and therefore will miss out on extensions to the language.

Protected codes

The second problem faced by Compact revolved around PC Basic's unique internal representation of protected codes. This means that if you have a normal protected MS Basic program, certain key statements (such as READ and PRINT) have been assigned special codes.

Because Compact had to transport a compiled program to the IBM PC, they had the task of re-entering the original source code so as to arrive at a protected version of the program under PC DOS. And it also meant that every time a change was made to the original program, several source programs would have to be changed.

Compact felt the source code route would be time-wasting and inefficient because it would require maintenance of different versions of the same program suites for the sole reason that some micros need a different source code.

Instead, Compact abandoned the IBM-supplied BasicA in favour of MBasic compiler running under PC DOS. By substituting, Compact can use the same source code on all machines because the protect codes are the same.

The company also had to get round the problem of physically putting the MBasic compiler and source program on the IBM formatted disk. This can be done with a system available from IBM for program conversion for the PC.

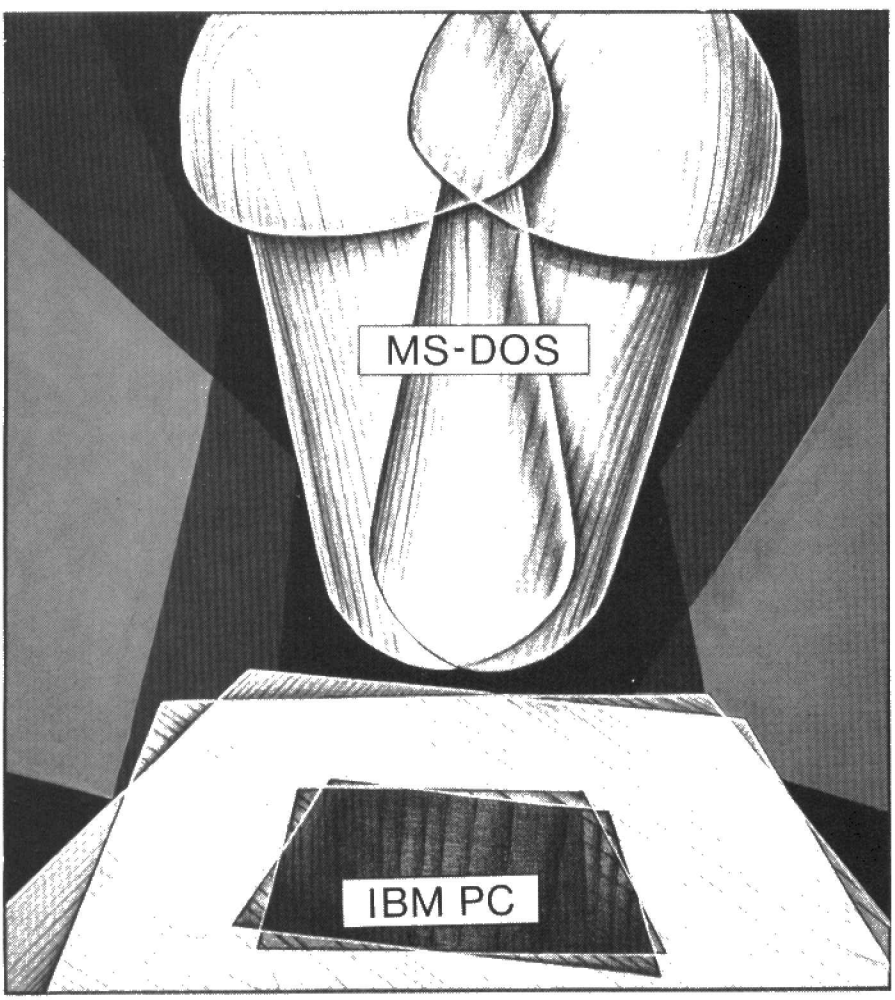
Asynchronous support

You'll need an asynchronous communication board for the IBM and an RS232 port on the master machine. Using a menu-driven asynchronous support package for the IBM, you can transfer the source code from another micro — such as the Sirius.

To solve the screen-handling difficulties, Compact has written its own assembler routines to access the address in storage which holds the screen image. These routines are called from MBasic.

During the initial set-up for any system, Compact specifies which micro is being used by setting the escape parameters to be used in any screen handling statements (such as LOCATE, PRINT AT, CLEAR SCREEN).

If the IBM is being configured, the system doesn't have any of these parameters but notes that the special assembler routines have to be called.



Why buy a matrix when all you need is a typewriter? David Jacques checks out the Olivetti Praxis.

The practical Praxis

Kieren Phelps

Home word processing is now quite common and is mostly done by tacking dot-matrix printers onto home computers. But despite the lack of publicity, cheap daisywheel printers are now a realistic proposition for those looking for a word processor that can produce letter quality output.

I purchased my BBC Model B early in 1982, and at that time converters which would turn the Olivetti Praxis portable electronic typewriter into a printer were appearing in the computer press. I bought a package manufactured by Vertical Data Systems of Ontario from Datarite Terminals.

You need a monitor rather than a domestic television set to see the 80 characters per line you get on A4 size paper, and of course you also need a good word processing program.

I chose an early version of Wordwise from Computer Concepts.

I already had a tape recorder, so acquisition of Wordwise meant I had a word processing system for about £1,150:—

BBC model B	£399.00
12in monitor	£103.50
tape recorder	£50.00
Wordwise ROM	£46.57
converter	£221.38
soldering	£25.00
Praxis 30	£295.00
TOTAL COST	**£1,140.45**

The Praxis is now cheaper, and £1,100 would be nearer the mark today.

The Wordwise chip plugs into one of the sideways spaces on the Printed Circuit Board. It therefore takes no memory, and is accessed by typing *WORDWISE. A full range of commands can be given by entering and leaving another mode, through pressing function keys f1 and f2. The editing commands are by and large excellent, and you can use the function keys to make up your own. These keys are worth using whenever there is anything repetitive.

Some useful information is given at the top of the screen. On the left hand side there is a word count, and on the right there is a countdown of how many characters are still free.

The greatest limitation is simply the computer's memory. Worldwise gives you 27,378 characters, and this is only about 4,500 words. At about 2,000 words it becomes impossible to display the text at 80 characters/line. Then, as the memory becomes very full, commands to move a lot of text are refused.

As a printer, the Praxis is much slower than those attached to office word processors. It takes about ten minutes to type 500 words, which is the number on a single spaced page of A4 paper.

There is also no automatic feed, and it's hard to get down to anything else if you have to return at intervals to feed the paper in.

But a more serious problem with my Praxis is that it can fail on occasion. For example, it may repeatedly print two or three characters in gibberish instead of text — this tends to happen on starting up. The only answer is to switch off to clear the cobwebs out of the Praxis's tiny brain.

It can also just seize up during printing. Once again, the only answer is to switch the Praxis off, but on these occasions you have to return to edit mode to move or delete the text successfully printed out before the seizure.

The BBC keyboard differs from the Praxis in several respects. First, the Praxis lacks some of the BBC's symbols, despite the great number allowed by the Keyboard 1/Keyboard 2 manual switch. It cannot print any of the ASCII symbols without equivalents in Teletext, nor greater-than/less-than signs, nor twin vertical bars, nor the Teletext arrows.

Second, many of the symbols are printed as other symbols. For example a dollar sign will print out as '¼' (*see table below*).

A Wordwise text of 27,378 characters would be 107 (Hex 6B) blocks long, and at three seconds per block this amounts to five minutes 35 seconds. The tapes to use are thus C12s, which give six minutes on each side. The best method of checking that saving has been successful is to CATalogue (*.).

27,378 characters would be about 4,500 words. Although this is the theoretical capacity of Wordwise, it is more sensible to keep the text on any one tape down to 2,000 to 2,500 words. Beyond this previewing at 80 characters is not possible, and the saving and CATaloguing procedure becomes boring, especially when SAVEing errors happen.

Is it worth stepping up to disks? You can cut the SAVEing and LOADing down to seconds. However, if you consider that 12 minutes at the end of, say, two hours is only an extra 10 per cent, then £400+ seems a lot for a home user to pay.

The Praxis may be the Citroen 2CV of daisywheel printers, but it is still good value. I am also enthusiastic about the Wordwise chip. Both have their flaws, it is true, but I have now submitted a manuscript to a publisher, and my wife now writes articles on the processor.

The surprise is perhaps that no one has yet built an electronic typewriter like the Praxis with a word processing program, a processor and a decent memory built in.

(i) Keyboard (ASCII)	(ii) Screen (Teletext)	(iii) Printer (KB1)	(iv) Printer (KB2)
!	!	.	.
"	"	"	⅛
#	#	£	£
$	$	¼	¢
%	%	%	|
&	&	&	°
=	=	=	÷
~	÷	⅓	⅝
{	¼	⅔	⅞
£	£	'	'
}	¾	¾	⅜
@	@	@	$
+	+	+	!
*	*	*	#
<	‹	,	2
>	›	.	3
—	—	—	—
]	→	½	½
/	/	/	¥

Chris Pointer, who has lived with the tiny PC-1251, shows some of its nice little touches.

A Sharp little operator

The calculator is growing up, and now a plethora of new hand-held machines are desperate to be crowned with the title of computer.

The battery-powered Sharp PC-1251 is no exception. At £180 for the rechargeable CE-125 microcassette drive, printer and pocket computer, the PC-1251 costs about the same as many 'real' computers.

It has 4.5K RAM, and the purchase price includes a suite of 20 programs. The machine itself combines calculator-style functions with several unique portable features.

You can define no fewer than 18 keys in the Shift mode — allowing you to allocate various Basic words, functions or small programs to those keys. In the machine's DEF mode, the same keys can be used to label lines of programming. You can enter a number of program routines with labels and then select and execute one of the routines.

You could use the DEF key to label and store a VAT routine under the label V. After that, you can RUN the VAT program by pressing V, because the PC-1251 has a non-volatile memory that doesn't forget the labels every time you turn the machine off.

The labels can be used to call sub-routines, or as programs are SAVEd on tape. Extended program names can also be used — for example, you can label, SAVE and LOAD the program VAT, then RUN VAT.

Once you've figured out what all the keys do, you can begin programming. You'll notice that the PC-1251 will accept program lines up to 80 characters long and that multi-statement lines of the type 10 A=1:B=2, PRINT A+B will be executed without any trouble.

Your listings can be viewed on the PC-1251 display using the cursor controls to move the display window. When the program halts, the line at which the program halted can be displayed, showing the last statement.

The key to programming lies in the PC-1251's ROM, and there are lots of little goodies locked up in the machine's operating system that would make even owners of larger micros envious.

PEEK and POKE are accepted, as is CALL. Using the PEEK and POKE facilities, you should be able to write Renumber and Line Delete software for the machine. The PC-1251 also accepts abbreviations, including ER. for ERROR: DEB. for DEBUG; OF. for OFF (although that 'abbreviation' isn't any shorter); CA. for CALL: RO. for ROM and K. for KEY.

If you spend the extra money (about £100) for the CE-125 microcassette and printer unit, you'll have a miniature version of the average home computer system.

The PC-1251 automatically stops and starts the microcassette under remote control, although it can of course be operated manually. The microcassette can be used to store progams, data, variables and reserve memory. Programs can

Four short routines which will give you an easy way of handling a range of tasks on your PC-1251.

These routines occupy only 459 bytes, leaving 3,027 bytes for other programs. The programs sit above line 900 (the maximum line number on the PC-1251 is 999). The programs can be called using the DEF key and their labels.

Value Added Tax

The VAT program labelled V, lines 953 to 971, calculates VAT paid on purchase/bills and from an input of purchase price displays price paid, VAT, price (value) less VAT, total for purchases entered and total VAT paid for those purchases.

Currency Conversion

The currency conversion program labelled H, lines 973 to 983, was written for pounds to guilders (HFL) or vice versa. The PC-1251 requests P Input for £s to HFL; H for HFL to £s, requests exchange rate HFL to the £, value to be exchanged. The exchange result is then displayed. This could be altered for other currency exchanges. But remember, the value must be expressed *to the pound.*

Cheque Book

The cheque book program labelled C, lines 993 to 999, requests cheque values and totalises withdrawals.

Shares

The share program labelled S, lines 985 to 991, requests share name, number held and current price per share. The name and total holding value are displayed as the result.

Program Lines 1 to 12 use PEEK to examine and display 20 bytes of memory. The top of the memory address range seems to be 64K (ie 65535) and ROM seems to be near the top of the memory map, although this is probably a reflection of lower memory. Finally line statements do not run into labelled routines.

```
  1:A=2^16:A=A/2: WAIT 6
  2: PRINT A
  2:FOR I=A-20 TO A-1
  3:PRINT I, PEEK I:
  NEXT I
 12:PRINT "END"
900:END : REM RESERVED
953:"V"S=0:G=0
955:" ": INPUT " VALUE ?
  ";T
957:G=G+T
959:V=T*.15:N=T-V
961:S=S+V
963:WAIT 360: PRINT "VAT
  =";V
965:PRINT "VALUE-"+"VAT=
  ";N
967:PRINT "TOTAL=";G
969:PRINT "TOTAL"+" VAT=
  ";S
971:GOTO " "
973:"H": INPUT "P=PDS>HF
  L:H=HFL>PDS ?";P$
975:INPUT "EX-RATE ?";E
977:INPUT "VALUE ?";N
979:IF P$="P" THEN PRINT
  "HFL=";N*E
981:IF P$="H" THEN PRINT
  "PDS=";N/E
983:GOTO "H"
985:"S": INPUT "SHARE NA
  ME 7 LETTERS? ";S$
987:INPUT "NO. HELD ";N
988:INPUT "PRICE NOW ";P
989:PRINT S$;" VALUE=";P
  *N
991:GOTO "S"
993:"C":T=0
994:"=": INPUT "CHEQUE V
  ALUE ?";V
995:T=T+V: WAIT 360
997:PRINT "VALUE=";V
999:PRINT "TOTAL=";T:
  GOTO "="
```

27▸

◀25

also be merged with those already in memory so that memory contents are not overwritten.

The CE-125 printer uses thermal paper and produces 25 characters per line, all in upper case. It is threaded using the paper advance button, but the printer paper should be handled carefully as finger prints don't make program listings any easier to read.

The microcassette and printer unit (into which the PC-1251 fits) is no bigger than a large paperback book, just a little over pocket size.

The CE-125 also includes a low battery indicator, an external cassette recorder input for loading ordinary cassette software. The recorder lead is supplied, so this shouldn't be a problem.

The four routines shown on page 25 are for business and home use, and demonstrates the machine's capabilities.

The PC-1251 has great potential, but has some limitations. String variables can only be declared seven characters long, while character arrays can be 255 characters long.

On the hardware side, the micro looks and feels well engineered but a slide switch is used to select mode (RUN, Program and Reserve), which is a little tedious — it would be easier to use the keyboard, as on the PC-1500.

But these limitations are far outweighed by the advantages of the PC-1251.

In addition to software supplied with the CE-125, Sharp's PC-1211 software should be compatible or modifiable. One company in the US has already launched circuit analysis software on microcassette for the new Sharp machine.

It is early days yet, since the PC-1251 was launched on the UK market only in January. I wonder how many portables will be launched this year? They'll need to be good to match this one.

That amazing little window

Coming from 'real' computers like the Apple II and the BBC Micro to Sharp's little PC-1251 pocket computer made me feel very old.

Not only had middle-age stiffness set in prematurely in my knuckles as I tried to press the Sharp's little keys, but the small LCD screen tricked my apparently senile mind into thinking the machine wasn't very powerful.

Screen

Although I later decided the key size was Sharp's problem and not mine, I remain amazed at how much the little LCD screen can take. It will display a program line up to 80 characters long, using a scroll-across 'window' on the line, 24 characters at a time. Not only does it display across, but you can also move the screen up and down, making it simple to review a program quickly.

The inventive screen layout allows you to see what the machine is doing at any time by the five messages on the top line. 'Busy' tells you the machine is working on something, 'P' indicates that you can immediately output to the printer, 'DEF' lets you access the programs stored on your user-defined keys, 'DEGRAD' tells you whether your angular movement outputs are being expressed in degrees, radians or gradients, 'Shift' indicates your characters will be shifted while 'E' indicates an error.

I had a minor quibble with the Shift key, as there is no shift lock and you must press Shift before every character you want to shift.

The 18 user-defined keys designated by the grey area at the bottom left-hand corner of the machine provide immediate access to common programs and routines that I had not expected to find on a £90 pocket micro.

Memory

The computer's non-volatile memory makes the key definition an even more useful tool, as you can permanently program useful routines into certain keys without having to download them every time you use the machine (although you can do it that way if you buy the CE-125 printer and cassette unit). The machine's soft break key is well placed and nowhere near as dangerous as those on most micros. Because the PC-1251 has memory safeguard, you won't lose your whole program by hitting break. Break will interrupt only the work you are executing at the time you hit it and it will only work in Run Mode.

Overall, the PC-1251 seems to be a well-designed and useful little machine. Certainly the small keyboard is a limiting factor, but this has been traded-off, rightly, against portability.

GW

SPECIFICATION

Price:	£91.95 inc VAT.
Processor:	8-bit CMOS CPU.
RAM memory:	System 500 bytes, program/data Area 3.4K, reserve 48 bytes, fixed memory area 208 bytes.
ROM memory:	24K.
Text display:	24 character LCD with 5 × 7 dot characters.
Keyboard:	52 calculator keys including alphabetic, numeric, special symbols, and numeric pad.
Interfaces:	CE-125 printer/cassette unit, external cassette interface on the CE-125.
Storage:	Ordinary cassettes or Sharp microcassette.
OS/language:	Basic.
Manufacturer:	Sharp Corporation, 061-205 2333.

Ted Ball tries a cassette which — for the programming orientated user — peps up the pixels.

Hi-res taped for ZX81

The standard ZX81 screen, with 32 × 22 characters or 64 × 44 pixels, does not allow sophisticated graphics. However, with Computer Rentals' High Resolution tape you can now get 256 × 192 individually plottable points on the screen. The high definition is produced entirely by software and needs no extra hardware except a 16K RAM pack.

Features

High Resolution sets up an extra display file using 6K of memory to hold the graphics. The program provides eight commands which you can use in your own Basic programs with statements of the form LET ZZZ = USR *address*.

These commands allow you to clear the high resolution screen, invert the screen (changing black to white and vice versa), display the normal screen, save a display file on tape and load it back, print a 'mini-character' of eight dots, or plot/unplot a single point.

Only the PRINT and PLOT commands actually contribute to producing graphics, which means you need to do a lot of work to build up anything more than simple graphs and diagrams. A package of this type really needs higher level commands which would allow you to draw lines, circles and other shapes easily.

Another feature I would like to have seen is a command to copy the high resolution screen onto a Sinclair printer.

Presentation

The cassette is clearly labelled with the names of the three programs on the tape; the high resolution toolkit itself, and two demonstration programs which draw sine curves and a three-dimensional exponential graph.

The documentation consists of a neatly printed 44-page booklet the size of the cassette box, with the left-hand pages blank for notes. The instructions give a comprehensive explanation of the commands and how to use them, and also how to deal with some of the problems you may find while using the toolkit.

The booklet also includes some useful Basic programs and subroutines which give you more help in using the package.

In use

You need to read the booklet and try out the examples before you start writing your own programs. It takes a little while to get used to the commands as you have to make sure you get everything in the right order, but there is really not a lot to learn.

It is easy to draw simple line diagrams and graphs, but more complicated figures can be difficult because of the way the high resolution screen is organised.

Although all the 256 × 192 points can be set to black or white they cannot be set independently. The basic elements of the display are actually what the booklet calls 'mini-characters' — rows of eight dots.

In order to get full 256 × 192 resolution you need 256 different mini-characters, but only 128 codes can be used and the mini-characters corresponding to these codes are not all different.

The PLOT command automatically selects the mini-character nearest to what you want but it may not be possible to get all the fine detail you want, and even if it is possible it has to be worked out carefully in advance.

The graphics are rather slow. For example, drawing a straight line from one corner of the screen to the opposite corner takes about 45 seconds in SLOW mode, and the demonstration program that draws the three-dimensional graph takes about eight minutes in FAST mode.

Using Basic to call the high resolution commands is much too slow to make moving graphics possible. One of the example programs in the booklet produces a space invader figure and moves it around the screen in response to the cursor keys. The booklet describes the movement as 'rather sluggish' but it is really painfully slow — you can see the figure being wiped out line by line and redrawn in the next position.

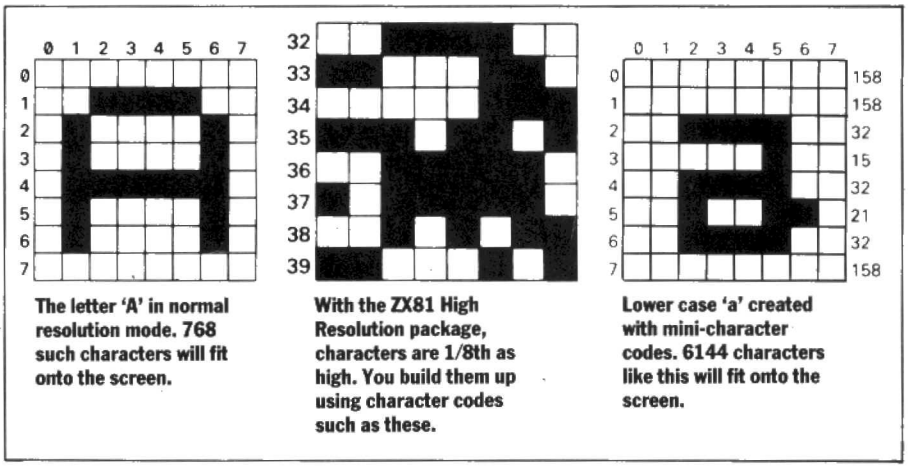
The booklet does say that 'with machine code, movement would be as good, and probably better, than when using the normal screen', but I was not able to try this.

Reliability

You have to use the program carefully to avoid crashing it because all the commands are accessed by USR calls and any mistakes in typing the addresses can crash the program.

You can save a lot of trouble by using meaningful variable names for the command addresses, starting your program with 10 LET CLS = 16790 etc, and then you can use the commands in the form LET ZZZ = USR CLS. As well as making it less likely to crash the program through a typing mistake, this also saves you having to look up command addresses all the time.

You also have to be careful to set RAMTOP according to the instructions before you load High Resolution, as otherwise any attempt to use it will crash the machine. The two demonstration programs test RAMTOP and give you an error message if it is not in the right place, but the high resolution toolkit does not, although you could add this test for yourself.



The letter 'A' in normal resolution mode. 768 such characters will fit onto the screen.

With the ZX81 High Resolution package, characters are 1/8th as high. You build them up using character codes such as these.

Lower case 'a' created with mini-character codes. 6144 characters like this will fit onto the screen.

Verdict

The better your programming ability the more you can get out of High Resolution. If you are restricted to Basic you will be able to generate static displays which can contain a lot of detail, but to get full value and produce reasonably fast moving graphics you need to write machine code.

The high resolution commands can be translated directly into machine code, and if you have some experience with it you should not find it difficult to use the package from your own machine code programs.

On the whole, High Resolution is a worthwhile program and does almost the same job as hardware add-ons which are advertised at prices up to £50. However, its speed and usefulness are restricted by the limited number of commands provided.

A few more commands, allowing you to work with larger blocks than points or 'mini-characters', would probably make moving graphics possible from Basic.

RATING

Features —
Documentation —
Performance —
Useability —
Reliability —
Overall Value —

Name High Resolution **Application** High resolution graphics **System** ZX81 with 16K RAM **Publisher** Computer Rentals **Format** Cassette **Language** Machine code.

Bottom Line Strategist promises to help you develop business strategies. John Wadkin tots it up.

Invested interests

According to the publisher dBase II colossus Ashton-Tate, Bottom Line Strategist is 'a business program for evaluating financial and marketing strategies . . . completely programmed and requires no programming knowledge . . . a tool for increasing productivity and maximising profit.'

You will use it, claims Ashton-Tate, to develop or evaluate business plans or marketing proposals; assess financial risks or investment opportunities; price products or services; make budgeting decisions; analyse the profitability of projects; and so forth. Enter your key business assumptions, and the Strategist will show you how practical and profitable your project is likely to be, in graphs and in tables.

In short it tackles the same kind of problems as a spreadsheet. But a simple spreadsheet with a spot of business graphics thrown in Bottom Line Strategist certainly is not. It is a CP/M package, and I tested it on the Apple II.

Features

You may feed in your assumptions about growth, marketing, advertising, costs, productivity, inflation and depreciation accounting, cost of capital, and pricing policy. You may review your assumptions, and print out a summary of them. You can compute the likely sales and profits of your venture, and you can examine, analyse and plot those results in a number of ways.

But you cannot enter any information about the reasoning behind the figures you enter to start the whole program moving, and you cannot alter the formulae the program uses to decide whether your business will succeed or fail, based on that crude input data.

Presentation

This software comes bundled up in a nice folder with two demonstration disks and a sealed pack containing the system disks.

The introductory manual — all 126 pages of it — is very thorough, but much of its content is easier to grasp by working directly from the demo disk. Too much of the manual is nothing more than a direct copy of the information given by the demonstration, with a handful of minor additions, while a few sections are poorly explained.

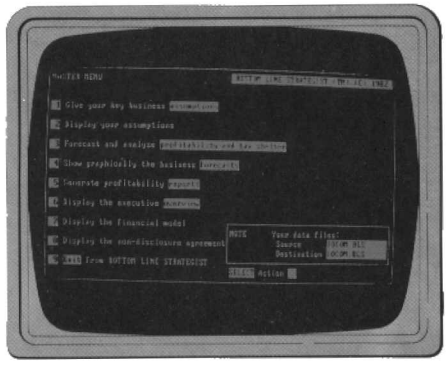
The glossary is an amalgam of computer-oriented references and a few of the commonest financial and business concepts.

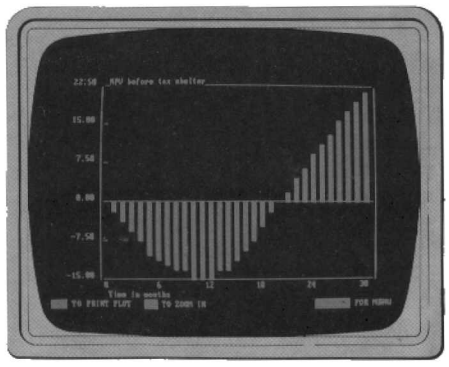
The average businessman will be irritated by the latter, while computer experts will be similarly vexed by the former. Many of the definitions are over simplified, if not banal, while others are academic and rarefied.

Getting started

Starting up is not straightforward, even though the manual suggests it is. There is no hint in the manual that the demo disk holds only the data for the first lesson. Lesson two is apparently only to be found on the sealed system disk.

You also need to be fairly familiar with CP/M when starting up this package. A program of this nature — aimed at business people who are not necessarily highly computer-literate — needs to be friendly right from the start, and these first few steps do not give the right impression.





In use

You, the user, must assess the vital assumptions on which your business is based in detail, then enter accurate figures for those assumptions. That includes your beliefs about your market, productivity, financial costs and accounting concepts. In all, you need to look at eight aspects of your business before you can expect to get worthwhile results.

The central section of the manual deals with the typical layout of each screen you will encounter, and the meaning of each entry, but some of the entries are still not clearly explained. I found myself almost having to guess at the order of the options on the method of depreciation, for example.

All in all, though, the sequence of inputs to the assumption tables and the outputs available is well thought out. There is a HELP facility which you can call up at various times, to get more detail on what options are open to you.

The tables generated by Action 3 are helpful, but I feel you really need to print them out, if they are to be properly readable. There is no automatic pause at the end of each page on the screen — the figures are continuously scrolled.

Graphing the tables, with Action 4, gives you a menu with a further 14 options. There is a convenient facility for 'zooming' in and out on the X or Y axis by a factor of two each time. But there seems to be no way to retain the plot on the screen, so it is essential to use the printer regularly during this phase. The axes stay, but the plot is temporary.

It would also be very useful to be able to plot and calculate three related sets of figures together — the likeliest, optimistic and worst figures for each possibility. BLS doesn't let you do this.

But it does have compensations, in the form of some pretty sophisticated functions. The manual mentions price elasticity as well as sensitivity, and risk analysis, though it does not make it clear how the BLS is to extract the relevant data.

I found BLS quick in its response when new data is input, though amendments take rather longer. Ashton-Tate also seems to have taken care to make the program crashproof, and the error codes within the system are informative.

Verdict

Once you have got over the initial hurdles to your understanding this package is quite user-friendly — indeed, parts of it are almost idiot-proof.

There are a number of concepts used which may not be relevant to the British user in the same way as they are to American companies; and some terms are poorly explained in the glossary, or even not explained at all.

The BLS could be a valuable tool for planning and assessing investment opportunities. But it is not particularly flexible beond the limits of the figures you input to its assumption tables. And those figures themselves are wide open to misuse since, as with most models of its type, BLS uses relatively crude input figures to produce highly detailed and accurate results.

This can be highly misleading, and there is little emphasis on this in the manual.

RATINGS
Features — ♀♀♀
Presentation —
Performance — ♀♀♀♀
User interface — ♀♀♀♀
Reliability — ♀♀♀
Overall value — ♀♀♀

Name Bottom Line Strategist **Application** Business strategy evaluation **System** CP/M 2.2, 64K **Price** £316.25 **Publisher** Ashton-Tate Format Disk **Other versions** Apple II, MS-DOS, CP/M-86 **Outlets** Pete and Pam Computers 01-769 1022/3/4.

PaperClip offers word processing at a budget price. Karl Dallas compares it to WordPro.

PaperClip's prose

PaperClip is a Canadian word processing program with many of the facilities of the much better known Commodore-based WordPro series. But it also comes complete with a stack of extra facilities such as the ability to move, format and sort columns of data, create contents tables, and use sophisticated printer set-up procedures.

It's quite a bit cheaper than WordPro, so even though it will memorise and manipulate considerably less text, it is worth while for Commodore users to take a look. It's also one of the first word processors on the spanking-new Commodore 64, but I tested the Commodore 8000 version.

Features

PaperClip has a mass of commands in common with WordPro, often using the same command key sequences. You can: insert blank line, delete line, print variable block, fill variable block from disk file or, in Wordpro, from extra text, set tab, set numeric tab on decimal point, clear tab, clear numeric tab, clear all tabs, exit to Basic, delete word/sentence, set range, move range, erase range, save range as disk file, duplicate (copy) range, find string.

The list goes on to include search string and replace, output to printer and output to video (all local and global), column add/subtract, screen read to status line, insert text mode and append text from disk file.

Some common formatting commands are:

Left and right margin, paper length, page length, right align, justify (with spaces between words), centring, page headers and footers (numbered), line feed, margin release, underline, force page, vary line spacing and (with some printers), use bold print.

So much for the things PaperClip has in common with WordPro.

Among its extra facilities are:

Verify SAVEd data file with text in memory, directory of both drives, change text between caps and lower case, change printer/disk device number, clear all non-numeric tabs, set italics, SAVE text as sequential file, LOAD sequential file, change line-length (plus horizontal scrolling), set/move/delete/erase/shift/repeat/sort column.

You can also SAVE to and LOAD from cassette as well as disk.

Presentation

The program comes on disk, with a clearly written, but unindexed manual of 112 pages, and a security chip which has to be fitted into socket UD11 on the main CPU board. This socket is normally vacant, unless another WP program is in use (VisiCalc-type programs usually use the neighbouring UD12 socket).

In use

LOAD and RUN in the normal way, and in a remarkably short time it is ready for text input. In addition to the format lines, which indicate cursor position by line and column and any special commands being inputted, it loads an initial blank line, which can be used for formatting.

Like WordPro, PaperClip is what is known as a 'post-formatted' system, which means that what you see on the screen as you type is definitely *not* what you get.

Typing is wrapped round from the end of one line to the next, taking no account of breaks between words, so that a five-letter word (like 'seven', for instance), may be broken with 'se' at the end of one line, and 'ven' at the beginning of the next.

This can be confusing at the start, but I have never found a typist who couldn't get used to it, while people (like me) who look at the keys rather than the screen hardly notice it at all.

There is an 'output to video' option which allows the writer to view the file(s) on screen as they will be formatted for print, before printing hard copy. This is also useful when wishing to begin printing from the middle of the document, because it is possible to scroll through the unwanted pages fairly fast on the screen, switching to print-out at the appropriate page.

The column-formatting facilities, coupled with the capability to scroll horizontally across a page of from 80 to 126 characters wide, will probably appeal to those whose work is largely financial, giving a sort of simple VisiCalc facility.

The 'what if?' capability is limited to addition and subtraction, of course, and no formulae can be incorporated, but totals can be printed out at any pre-determined place, not merely at the bottom of columns of figures.

Sorting allows lines of text to be rearranged into alphabetical order, numerical or chronological, defining any particular column as the key field, and thus making it a fairly primitive database (though not so primitive bearing in mind the find and search/replace options).

Names and addresses could be created within the program, sorted into alphabetical order, and then SAVEd as a sequential file, allowing them to be accessed by a simple label printing program (they could also be printed from within the PaperClip program, of course).

WordPro text files can be called up and edited from within the PaperClip program, and vice versa, but since both programs have security chips in socket UD11, a socket switching device would be needed to use both on one machine.

The Commodore 64 version is protected by a dongle fitted to control port 1 which can be changed much more easily.

PAPERCLIP
has
114 lines of text = 9,120 characters
28 printer set-up options, plus user-definable set-up program
LOAD/SAVE sequential files
VERIFY SAVEd file with file in memory
Both drives directory
Set, move, kill (erase) phrase, change case of phrase (caps to l/case & vice versa)
Change disk, printer device number
Set, move (transfer), shift over, delete, erase, insert before, and repeat columns
Set decimal point 0-38 places or floating point
Add row as well as column
Change line-length (40-126 columns on 40-col screen, 80-126 on 80-col screen) with horizontal scrolling
Super/Subscript begin and end for multiple characters
Italics on/off
Indent with 1m+*n* command, reset by 1m+0
Link during print from within text to file on disk, defined after user prompt
Switch from sheetfed to continuous print during print, and vice versa

WORDPRO
has
Extra text facility
142 lines of main text + 23 lines extra text = 13,200 characters
Selective directory of one or both drives
Directory displayed in four columns on screen
Go to *Line n*
Print to disk (permits subsequent use of keyboard during hard copy print out)
Global copy of linked text files from one drive to another

Verdict

PaperClip seems to perform pretty well. Its ability to cope with WordPro files should be a good selling point, despite the slight hitches you run into when moving between the two.

The main problem with PaperClip is its limited text memory — and that will be a real black mark as far as many users are concerned.

Nevertheless, at a cheaper price than WordPro, its extra facilities might make it more attractive if length of text in memory is not a prime consideration.

Name PaperClip **Application** Word processor **System** CBM 8000 series **Price** £171.35 **Publisher** Batteries Included, Toronto **Format** Disk **Language** Assembler **Other versions** Commodore 64 (£98.90), Commodore 4000 (£148.35) **Outlets** Kobra Micromarketing

MICROWAVES

Got a tip? Send it to *PCN* and get a cash reward. £5 for every hint printed.

If you've got something to crow about . . . a bit of magic that'll make the world a better place for micro users, then send it to *PCN* Microwaves—our regular readers' hints and tips page. We'll pay you £5 if we print it. We'll pay you even more if your little gem gets our vote as microwave of the month. Think on . . . and write to Microwaves, *PCN*, 62 Oxford Street, London W1A 2HG.

Neat numbers on the ZX81

Here's a useful subroutine for printing numbers neatly on a ZX81 screen. The subroutine displays the number (contained in A) rounded to two decimal places and lined up at column B.

```
900 LET A$ = STR$(INT((A+.005)*100)/100)
910 LET A$ = A$ + (".0" AND VAL A$ = INT VAL A$)
920 LET A$ = A$ + (".0" AND A$(LEN A$-1) = ".")
930 PRINT TAB( B-LEN A$);A$
940 RETURN
```

John Convery,
Winlaton, Blaydon-on-Tyne

Lynx scroll discovered

The Lynx, which everyone seems to think cannot scroll, has hardware which enables some very complex scrolls to be achieved. Using the OUT command, the screen can be moved in any direction.

The Z80 I/O port 86 hex seems to control the direction, and port 87 hex the distance, of the scroll. For example:–

```
OUT &0086,12
OUT &0087,A
```

moves the screen 3*A lines above its normal position, while

```
OUT &0086,13
OUT &0087,A
```

will move the screen left by (A MOD 64)*4 pixels and up A DIV 64 lines. You can use these ports to scroll the screen upwards:–

```
10 REM Scroll demo
20 REM initialise scrolling
30 GOSUB 1000
50 REPEAT
60 PRINT "HELLO"
70 GOSUB 2000
80 UNTIL FALSE
90 END
1000 REM initialise scrolling
1020 CLS
1030 LET A=O
1040 OUT &0086,12
1050 OUT &0087,1
1060 RETURN
2000 REM Scroll 1 line
2010 OUT &0086,13
2020 OUT &0087,(A MOD 3)*64
2030 OUT &0086,12
2040 OUT &0087,INT(A/3+1) MOD 8
2050 LET A=(A+1) MOD 24
2060 RETURN
```

James Key,
Deighton, York

Deaden Oric's decibels

If you make an awful noise while programming your Oric 1, you'll need a quick way of turning the sound off. If the keyboard blip is on, simply press a key. If the blip is off, just type CRTL-F twice. Instant silence!

Barry Merrick,
Brentwood, Essex

Play dirty at Planetoid

An undocumented *FX call on BBC MOS version 1.0 onwards is *FX 210,X. If X is 1 then the call will switch off all sound output. *FX 210,1 turns the sound back again.

Anyone who wants to get a really high score at the cassette based version of Planetoid could do worse than swallow their pride and try the following:–

```
Press [BREAK]
enter PAGE=&3C00[return]
      LOAD "Planet1"
      [return]
```

When the program is loaded, enter:–

```
150 ?&276B = &99 [return]
RUN [return]
```

After loading the rest of Planetoid, the game should start with a generous 99 lives!

James Bridson,
Barnsley, South Yorks

Lighten those long LOADS

If you're using your BBC micro for word processing, you can get into problems with long documents. I use Wordwise and often LOAD only parts of long files. To do this, you need to know roughly where in the file the piece you want is. Then use *OPT 2,0 and fast forward/rewind to read only the blocks that you want.

The BBC will LOAD just this part, corrupting only the first and last blocks. As a rough guide, you get around 50 words in a block.

Colin Cohen,
London W11

Track programs on your TRS-80

Not knowing the name for a system tape on a TRS-80 means you can't LOAD it in. But this program, when RUN with the cassette recorder going, will print a 'U', then the program name.

The cassette recorder will stop, then you can type the name in and LOAD it normally. You don't even need to rewind the cassette. The program is:–

```
10 INPUT # -1,A$: PRINT A$
```

David Marchant,
Egham, Surrey

Banish those Atari blues

If the Atari's blue screen annoys you, try entering the following commands before you start programming.

```
POKE 1536,141
POKE 1537,198
POKE 1538,2
POKE 2,0
POKE 3,6
POKE 9,2
```

Press RESET and the screen colour will become dark grey. The POKEs write a small machine code program that is executed every time the machine is reset.

S C Bickle,
Kettering, Northants

LYNX ROUND-UP

We've had so many hints and tips for the Lynx, it's time for a quick summary. There are seven commands in the ROM that do not work. Trying to use them gives the message 'Not yet implemented'. Here they are, with their correct syntaxes:–

```
PAINT X,X,X
USER0(X)=X
USER 1 (X)=X
USER2(X)=X
USER3(X)=X
PRINT LIGHTPEN(X)
PRINT JOYSTK(X)
```

To see the Lynx command table for yourself, use the command H 11EO from the Lynx monitor. Simon Brookes points out that you can fully reset the Lynx by entering the monitor and entering G.

The Lynx does have single dimension string arrays. To use them, dimension the length of the strings in the array and then include the number of strings in brackets afterwards. So DIM A$(20)(10) creates an array of ten strings, all 20 characters long. The elements are accessed with A$(0),A$(1),A$(2) and so on.

There are no two dimensional arrays but these are easily simulated. To access a 5×4 array at the point X,Y, use a statement such as DIM A(20) followed by PRINT A(X+5*Y).

Clive Newton of Sutton Coldfield notes that you can't enter every ASCII character from the keyboard but you can get a few more (such as \,–, and]) if you put the keyboard in its 'graphics mode'. He included a routine which makes a new copy of the keyboard scanning routine where the square bracket keys generate square brackets with the shift lock on and arrows with it off.

```
10 RESERVE 40424
20 CODE 21 BD 09 11 4D 9E 01
        A9 01 ED b0 21 AB
   9F 22 EF 9F 21 4D 9E 22 B2
   9F 21 DE 9E 22 62 9E 21 06 9F
   22 85 9E 21 6F 9F 22 90 9E 21
   42 9F 22 9B 9E 3E 5B 32 38 9F
   3C 3C 32 3D 9F 3E 7B 32 A1
   9F 3E 7D 32 A6 9F 21 EB 9F
   22 04 62 C9
30 CALL LCTN(20)
```

ZX81 ROUND-UP

Continuing our series on ZX81 ownership, Jonathan Rhodes of Eccleshill, Bradford cured the problem of faulty line feeding. The trick is to wind sellotape around the black roller so that it is in firm contact with the paper roll.

Mark Forrest of Aughton, Lancashire has been to even greater trouble. Three or four minutes' work will help stop Rampack wobble and tilt the printer, which often helps to improve its print quality.

Open the casing on the printer's plug by removing the two screws underneath. Then turn the card over so that its wires are effectively on the other side of the card. Carefully replace the casing upside down (with the screws upwards). You can then plug the printer into the ZX81 the wrong way round and sit the printer on top of the ZX81.

The Scorpio 8 is gunning for the Winchester mass storage market. Francis Monkman has it covered.

Fast on the draw?

When I was asked to review the Scorpio 8 disk system (for Apple II), I had already expressed an interest in the product.

It seems to have a lot going for it while cheaper 5.25in Winchester drive prices seem to have levelled out (I am thinking of around £1,200 for a 6 Mb drive with controller, interface and software). Why not develop a new 'super-floppy', borrowing the Winchester concept of stacked platters, and cram each one with as many bytes (1.2 Mb) as the latest multi-density technology will allow? Bright idea, huh?

HAL's advertisement screams death (literally) to the Wild West Winchester that has, although expensively, opened up mega storage power to the micro.

Can Scorpio 8 make a dent in this new market? Or will the expected mini-mini Winchesters (micro-Winchesters?) take the price of mass storage so low that the floppy will just be the thing we hang on the front of the machine to exchange/install software?

I'll attempt to evaluate this product in terms of the maker's claims for it, as well as comparing it with the other two main alternatives: standard floppy and 5.25in Winchester.

Presentation

Physically, the Scorpio 8 resembles, not unnaturally, an oversized floppy drive. Presumably the extra length accommodates the unit's power supply, making the total weight about the same as an Apple. Construction is of metal, lending a robust appearance.

Hookup is via an impressive-looking controller card, originally destined for use with 8in floppies. The drive door, instead of the usual swivel-in-the-middle floppy arrangement, is a gate which swings down to reveal a slot big enough to hold five vertically stacked floppy disks in a special plastic cartridge.

Once inside the Scorpio individual floppies are grabbed by the mechanism when needed and dragged quickly into the drive. After being accessed by the read/write head they are slipped back into the cartridge.

This frantic activity is understandably accompanied by a series of strident clunking sounds.

These floppies can be swapped or replaced from the removable cartridge but there is one important point that you may have missed if you read the advert: these are not ordinary floppies.

There is a square cut-out to one side of the read area, which provides vertical alignment of the disks, and the write enable/protect cutout is now on the edge of the disk that faces the drive. You are also warned not to use floppy hub reinforcers on Scorpio disks.

I am sure that disks are readily available, but this feature removes one of the immediate attractions of the unit as Apple users will have to duplicate many of their existing disks.

In Use

My experience on power-up, after some rather endearing clunks from the drive, began with the installation of the system software. This builds a version of DOS 3.3 which is then used to format the Scorpio.

Individual disks are formatted separately, which is obviously necessary but long-winded in the absence of a "0 = ALL" override to the prompt "DRIVE 1-5?".

Did I say format . . .? Several hours, coffees, calls to Farnborough, and the removal of almost every other card in my Apple later . . . I try again. This time everything works, but be warned. Scorpio uses DMA (direct memory access) to dump things in and out of memory quickly, and it doesn't like anything else that does.

Meanwhile, back at VFORMAT, things are progressing. Now the track/sector counter really does 'whizz by' like the manual says, instead of sitting glumly on zero while the screen spits random ASCII. All well, but I feel that the installation of a system should be made simple for the user, who may be a first-timer.

When it came to formatting for CP/M, I found myself having to invoke DDT in order to transfer installation files by block, although all this is clearly explained in the manual. If I'd had two floppy drives the thing would have been easier, but I think many potential customers will be considering a unit like this as an alternative to a second floppy.

Another point, which HAL has not properly considered is that in Apple DOS it is unnecessary to INITialise (format) a

FIGURE 1

Speed test for text file handling

	Disk II	Q/Charge	Scorpio 8	Q/Charge	Ice Winchester
BSAVE 32K	00:38.5	00:26.0	00:27.8	00:06.8	00:15.0
BLOAD 32K	00:32.7	00:09.2	00:25.0	00:03.6	00:10.8
WRITE	02:00.0	01:56.7	01:39.4	01:40.9	01:25.4
READ	01:50.5	01:50.4	02:47.7	02:08.0	01:33.9

	Disk II	Scorpio 8	Ice Winchester
WRITE	00:38.3	00:44.9	00:17.3
READ	00:36.0	02:52.7	00:16.7

FIGURE 2

Speed test for CP/M and MBASIC

	Disk II	Scorpio 8	Ice Winchester
CTRL-C	00:02.5	00:08.9	00:1.2
MBASIC	00:05.3	00:04.1	00:1.7

(all timings in mins:secs.tenths)

diskette before running COPYA. COPYA does it for you.

Certainly my experience with installing Winchester systems has been much less painful.

Next I tried some timings. Not being in possession of any standard benchmark programs, and being somewhat pressed for time, I reasoned thus: Apple disk files are of two main types, text and binary. The latter includes program files. These handle quite fast, but the former are used for data storage by much text/record-based software, and process notoriously slowly.

For comparison between the three media: Apple DISK II, Scorpio, and ICE Winchester — which also runs a modified DOS 3.3 and CP/M — I ran four tests in both operating systems.

These comprised BSAVE (binary file save to disk) a 32K byte block (the maximum allowed by Apple DOS); BLOAD (binary load from disk) a 32K block; WRITE a textfile to disk of 1000 strings of 32 characters + RETURN i.e. 32.25K; and READ 32.25K textfile from disk.

I appreciate that this does not begin to cover the multitude of multi-file, random access etc applications of daily use, but as most of these are largely dependent on the core of whichever operating system you have running, these simple tests give a good basis for evaluating HAL's claims of achieving hard disk speeds.

One more thing: HAL has provided a routine called Quickcharge which speeds up DOS 3.3, or at least some of it.

I have included timings for the four tests with and without Quickcharge, both on Scorpio and DISK II. I wish I could have got Quickcharge to run on the Winchester. The results for these and for CP/M 32.25K sequential files are given in Figure 1.

You may be as surprised by some of this as I was. In fact, I was so surprised at the slowness of Scorpio to read textfiles that I ran the test again. I won't tell you the result, because my thumb slipped on the stopwatch button, but it was over three minutes.

Mercifully, the second run of the CP/M textfile read was down to 2mins 27.6 secs, a small encouragement. You may also notice that Quickcharge doesn't seem to affect textfile handling beneficially. Binary file timings, though, are extremely impressive, and I can imagine that the manual's demo for switching high resolution pictures looks very smart. I also did a few other timings in CP/M, notably for CTRL-C (system reboot) and for running MBASIC.

These are given in Figure 2.

Curiously, the Scorpio seemed consistently slow on reboot, but having found itself all was well. I was compelled to boot from DISK II, however, because when I booted from Scorpio my DISK II failed to appear (according to the manual it should come up as drive I: or J: in CP/M terminology). In fact, having provoked a system failure by looking for it, from which even <RESET> failed to rescue me, I discovered one of those things which

experience teaches better than words. Never power on/off with disk-pack in the drive.

It's inadvisable with floppies, but most of us do it all the time. With Scorpio it's definite — try it at your peril.

Verdict

As for HAL's claims — and I don't really think Winchesters are doomed, but ask HAL, they sell them too — I worked out the cost of Scorpio at about 5K per pound. Certainly, if you included tape stream backup for the Winchester, things would work out a lot dearer.

I agree HAL has got a strong advantage with its 'removable media', but forget to take the pack out of the drive and your media really will be removed.

So, to those people who run large, disk-dependent programs, and are considering Scorpio as a low-cost alternative to a Winchester, I would say: if you are sure that most of your data storage is in binary format, then this device may represent excellent value for money.

If, however, your program(s) make intensive use of textfiles (and that effectively includes the VisiCalc family, as well as most databases and commercial software packages) then you may find that the good ol' Winchester still has a decidedly faster draw.

Make Scorpio 8 disk sub-system **Host computer** Apple II **Price** £895 plus VAT/Cartridge £45 plus VAT **Contact** HAL computers, Farnborough (0252) 517171

Ian Scales makes the Dragon roar as he tunes up the new Sound Extension Module.

Bang! Splat! for Dragons

The Sound Extension Module comes in the guise of a games cartridge, and adds a sound score to your Dragon's tape-based programs. This can be any of a range of sounds, from synthesiser-type to photon torpedoes.

It plugs into the Dragon's expansion port and effectively occupies part of its memory. This means it's relatively easy to get to, and you don't have to POKE out of the computer to get some sound. Instead, the module adds another command to the Basic — MUSIC, and the various sounds are nominated by numbers and characters as MUSIC's variables.

The module is based on the AY-3-8910 sound chip, and most of the available sounds are controlled by the sound generator, not the processor. This means you are able to 'score' your programs as they unfold on the screen without dominating the attention of the processor.

It's possible to write a processor-hungry graphics program RUNning alongside a fairly musical piece without the problem of the system grinding to a halt under the work-load.

You can't expect too much for the module's price — £34.95 (inc VAT) and hardly surprisingly the SEM will not cause too many record company talent scouts to beat a trail to your door in search of the next Depeche Mode. Techno-pop it is not — it's just a lot of fun.

Music encompasses tone-specific noises of the ditty variety, percussive effects (just reminiscent of drums) and concussive effects emulating an entire arsenal (no, not the team) of destructive devices — bombs, torpedoes and firearms.

PCN's review model was actually a prototype, and the circuit board was housed in a black plastic box. But JCB says it is putting together a natty casing with an embossed logo for when it goes on sale to the public later this month.

Music commands must be specified by strings, not numeric variables. You set-up by entering statements like A$="C3//" — C stands for the musical note c, while 3 stands for a middle-range octave.

Octaves run from 1 to 5 and the length of the note is measured by the /. Each / represents about .25 of a second. It's also possible to specify semi-tones by the addition of # (sharp) after the musical letter.

Once you've defined the string A$="C3//" the note can be called in at the appropriate place later in the program by including MUSIC A$.

JCB recommends that you save time and effort by using DATA and READ statements like:–

```
10 DATA C3//, E3//, G3//
20 READ A$, B$, G$
```

The sounds are then produced in the program by: MUSIC A$, B$, C$ — simple, huh?

Much of the sound operation is under the control of the sound generator, but 'tempo' can be rather a hit or miss affair. If the processor is busy drawing on the screen it can lose its breath and become a little erratic when delivering the sound commands to the generator.

The solution is to insert compensating READ and MUSIC statements in the critical places (on a loop, say).

Another problem is your music speeding up for the opposite reason — when the processor has nothing to do but pass on music commands. This is overcome by inserting spurious REMs or delay routines.

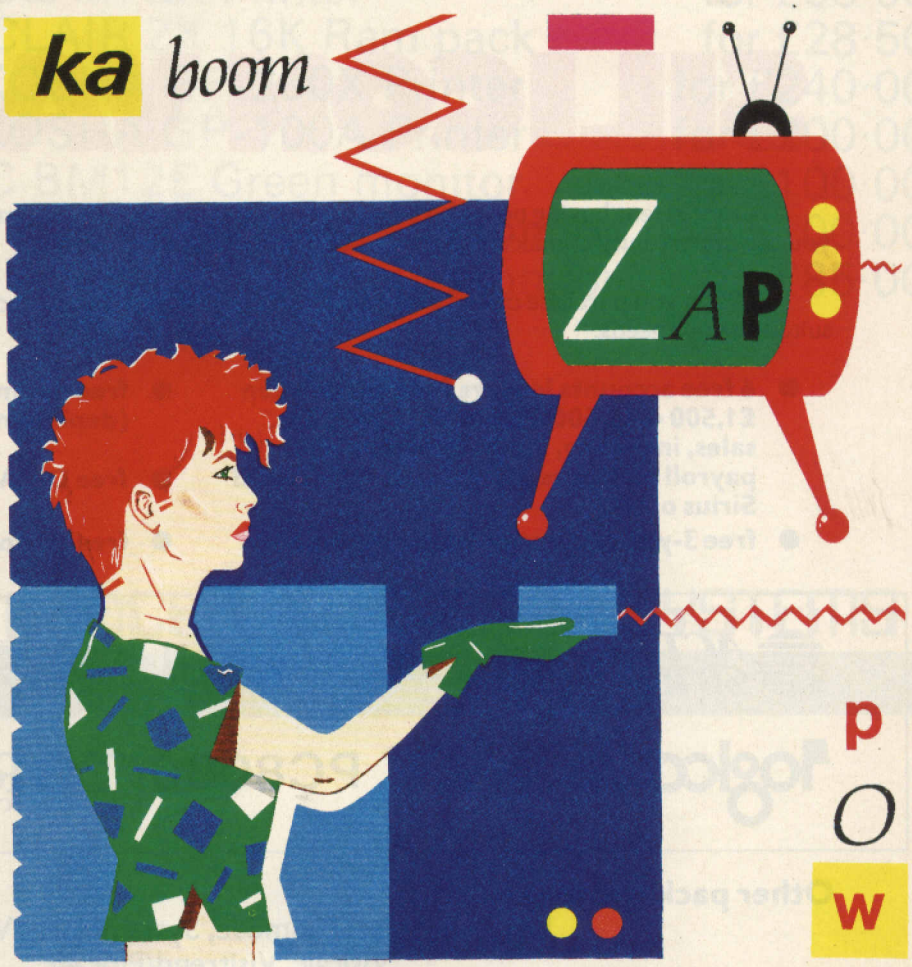
Volume variations may be inserted by adding numeric values from 0 to 15 in the data statement above:–

```
DATA C3//, E3//, G3// 12,10,8
```

Four pre-programmed percussion instruments — bass drum, tom-tom, snare and cymbals — are nominated by the letters A to D under the music statement. Admittedly, percussion is a difficult sound to reproduce, and even the most sophisticated equipment can sound a little tinny. The SEM drum sounds are reminiscent of a stereo system being repeatedly disconnected from a wall socket.

For the games fanatic the sound effects will be a favourite area. These are divided between generator-controlled and processor-controlled effects.

The more murderous, staccato range of noises like gun-shots are controlled by the sound generator. These have the advantage of allowing the processor to continue with the other tasks while the sounds are generated. They comprise 'explosion', 'rifle-shot', 'pistol-shot', 'machine-gun' and 'ping'.



Processor-controlled effects seem to be those requiring more sustained sound. These comprise siren, laser zap, falling bomb and photon torpedo.

JCB will be adding other sounds, and these could include a 'raspberry', 'klaxon', 'American siren', 'waves' and 'car horn'. There are also facilities for redefining the musical note set in RAM and altering the generator-controlled effects.

As we said the SEM is not a state-of-the-art sound synthesiser but at about £35 all up it is very good value for the Dragon.

As PCN went to press proper documentation was not ready, but the rough draft was clear and comprehensive, and it's reasonable to suppose that the finished product will be adequate. With the proper casing and extended selection of sounds the Sound Extension Module should make the Dragon roar.

Machine Sound Extension Module for Dragon 32
Price £34.95 inc VAT **Manufacturer** JCB Microsystems, tel 0202 423973

Despite the sleek outer casing, Richard King detects some rough edges in its operation.

TYCOM Microframe

The Tycom Microframe must be one of the most highly-trumpeted computers ever launched in this country. From the initial publicity you would have thought somebody had put a Cray 4 in a box, and was selling it for the price of a good Cortina.

There's been much bandying of three-letter acronyms in its presence, too. Like OEM, PCM and, most prominently, VBC. Suppose it impresses folks.

But what is this VBC, anyway? Versatile Bus Connect — or Concept, depending on who's going on about it — that's what. Still doesn't mean much, though. I won't make the obvious cracks about the four-wheeled variety, or about 'omnibusses'.

VBC is an adman's way of telling you that you can put all kinds of gubbins in the back of your computer — up to and including a couple of other computers — and still make it work comprehensively.

This is actually what people have been doing with the Apple II for years, and that isn't the only one either. What about S100? IBM PC with a Z80 card?

So what's the difference? The others don't have an impressive name for doing something unmentionable with some homebrewed dooberry, which you've foolishly plugged into your precious computer — they call it something dull like interfacing. VBC sounds so much better, doesn't it?

There is one small difference between this VBC and simple interfacing on all the others (except Apple).

On most machines, the chore of informing the operating system of its host's new capabilities is performed by adding a new driver to the system. You have to write this if it hasn't been supplied.

But on the Microframe this comes on the new peripheral — as it does on the Apple.

Hernia time. The Tycom Microframe series appears to be made of cast iron with elements of sheet steel, but it does look good.

Ian McKinnell

Presentation

The packaging for the Microframe is much as one has come to expect — foam shapes in a sturdy cardboard box. The fact that it's *heavy* therefore has nothing to do with the packing.

Yup, hernia time. They used to make railway engines out of cast iron, and they seem to have used the same stuff here — hit it and it goes *Ting!* Lovely crackle finish, too, in any one of three co-ordinated colour-schemes.

Everybody thinks it looks great, just like a computer ought to look. A couple of transient inhabitants of the office even said they'd buy it on the strength of that alone, and they've been booked into a nice home, just near Bexhill. We hope they'll be very happy.

I've no idea what possessed Tycom to build a computer in such a fat-headed material, but if anybody so much as mentions the phrase 'heat-sink' anywhere near me I just laugh.

You could cool a blow-torch with that lot, never mind a few harmless bits of silicon. Maybe Tycom has a fiendish plan to make a killing by selling reinforced desks.

As regards completeness, it was — even down to the plug and obligatory stencilled erratum/addendum, without which all machines are useless.

Documentation

The main documation was in the form of an A5 ring-bound user manual of 99 pages. It had no index but was broken up into suitable sections, including a large one on installation and setting up. There was also an introduction and sections on the keyboard, fitting and removing cards, and CP/M-86.

The section on CP/M was usable only by somebody who had a good idea of what was going on, and unfortunately the same

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applies to the rest. Beginners should therefore look elsewhere.

Construction

The physical construction of this machine bears a superficial resemblance to most other machines. That is to say, it has three parts: a main unit, a VDU, and a keyboard. From there on, it's different.

The mass of the machine (in both senses) appears to be cast iron with elements of sheet steel.

The main unit has enough fins to make one think it fell off a Japanese racing-bike. There are two 5¼in floppy disk drives in the top half, and a nameplate on the bottom.

Behind the nameplate is about the silliest place anyone could think of to put a small recess containing some pretty important controls. The reset button and the boot selector are there, as is a very important indicator, which is your only way of telling what's wrong with the machine when it won't work.

The nameplate swivels sideways to reveal the recess. Inside there's the red reset button, an LED, and a miniature rotary switch.

The reset button is much too accessible and tempting. It should be a real hassle to get at.

The boot selector sets which slot is to be used to load the operating system. This should also be a dark secret — not sitting in front of everybody, asking to be twiddled by any passing moron.

I have left the LED till last, because it's a real work of art. It's supposed to tell you what (if anything) happened when the machine was booted. Depending on the status, it flashes up to seven times. Once is OK, and means a successful boot. Two to seven means trouble.

The trouble is that nobody seems to have realised that the only time you'll know about a problem is *after* the light has started flashing — and who starts counting before they have a reason to?

The idea of just one light providing the necessary panic information for a range of problems is obviously a good one from a designers point of view, but where real people are involved it's not so smart.

The only other detail is a huge green band running across the top. There's a little hole in this beam, and to get the end of the little peg under the VDU into the hole, you just heave some 25 pounds of fragile electronics sheathed in heavy engineering into the air.

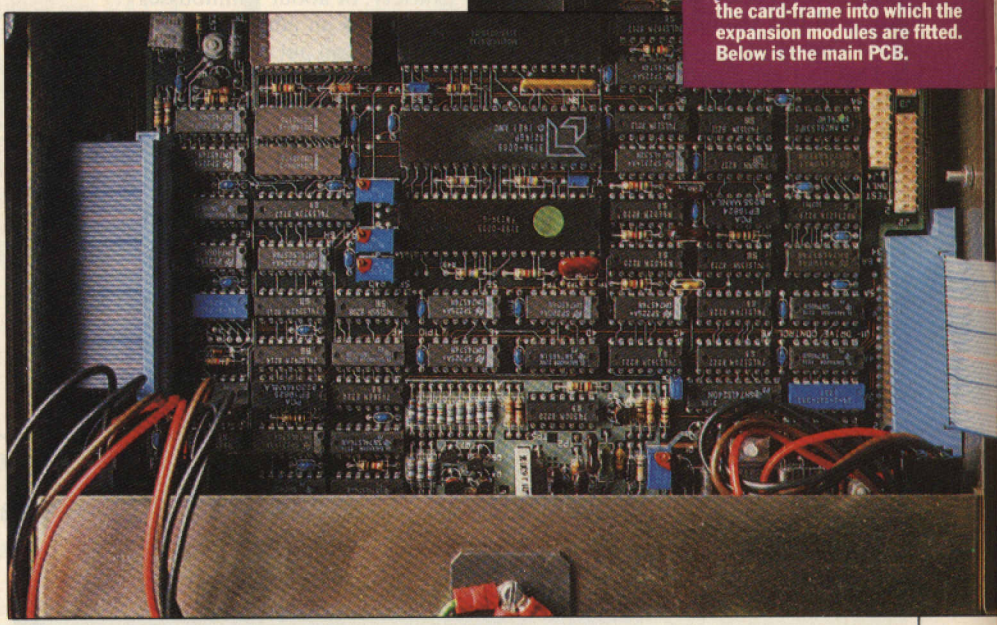
You then have the problem of seeing through some 12in of something that'd slow up a neutrino to see where the little peg is in relation to the hole. You could gently drag the VDU about until it fell off the edge, or into the hole, but I didn't think it would be a good idea.

Keyboard

The keyboard appears to be built up from a modular system. The housing is cast metal, again, and instead of the usual panel through which the groups of keys protrude, the space is filled with little tiles, the same size and shape as the keys.

There are also 'illuminated' tiles, each of which has an LED behind it. These can be controlled from a program, and can serve as indicators for the operator. There are seven of them at the top right of the keyboard.

The keyboard has the normal qwerty layout, a numeric keypad, a cursor-control pad, and ten function keys. The function keys are programmable and each may have three definitions: unshifted, shifted and double-shifted. The first two are as normal, but the last is a real dinger.



The physical design of the Microframe is very neat. Above is the card-frame into which the expansion modules are fitted. Below is the main PCB.

To use it you have to push both shift keys at once, as well as the function-key itself. It isn't an easy movement for anyone, but anybody with a span of less than 160mm will find it isn't even possible for F4 and F5.

I suppose that, as the machine appears to have been designed and built in the grand old tradition of heavy engineering, the test-span used may have belonged to a horny-handed son of toil/steelworker.

Nevertheless, the more petite of us will face real problems here.

Screen

The VDU screen is a separate unit which sits on top of the main unit. It tilts backwards from horizontal to about 15 degrees, and swivels. The tilt has not been thought out very well but would be just about right on a model 6.

I tested the Microframe 12, and didn't need any tilt at all, since it was at eye-level. But the model 22 is some inches higher, and so would need to tilt down if anything.

The silliest feature of the VDU is the fact that the only limitation on how far the VDU can turn is the cable. A careless elbow could catch on the screen, and I don't imagine that all that metal, rotating rapidly, will do a lot of good to the plug which stops it short.

The quality of the display was bad, to put it mildly. The interlace was grossly unstable, so each alternate line wobbled. At the corners some letters became quite unreadable (x, n, s, w, u for example), and the edges of the signals were slushy, so that verticals disappeared when inverse mode was turned on.

On certain occasions, especially when displaying inverse at the top, the display literally fell apart. Considerable work needs to be done in this area.

Storage

Permanent storage is on the two 5¼in floppies, each holding a respectable 680K. There are a few oddities about the drives, the first being the incredibly long timeout.

If you access the disk, it keeps on spinning for about 20 seconds after the indicator light goes out. Normally I'd not have noticed, but for the noisiness of the drives themselves. Not the Trash-80 type of noisiness, but more abrasive, suggesting excessive head-pressure.

The least noticeable oddity of these drives is the fact that whichever drive you use, both start turning. Evidently, Corners Have Been Cut.

Expansion

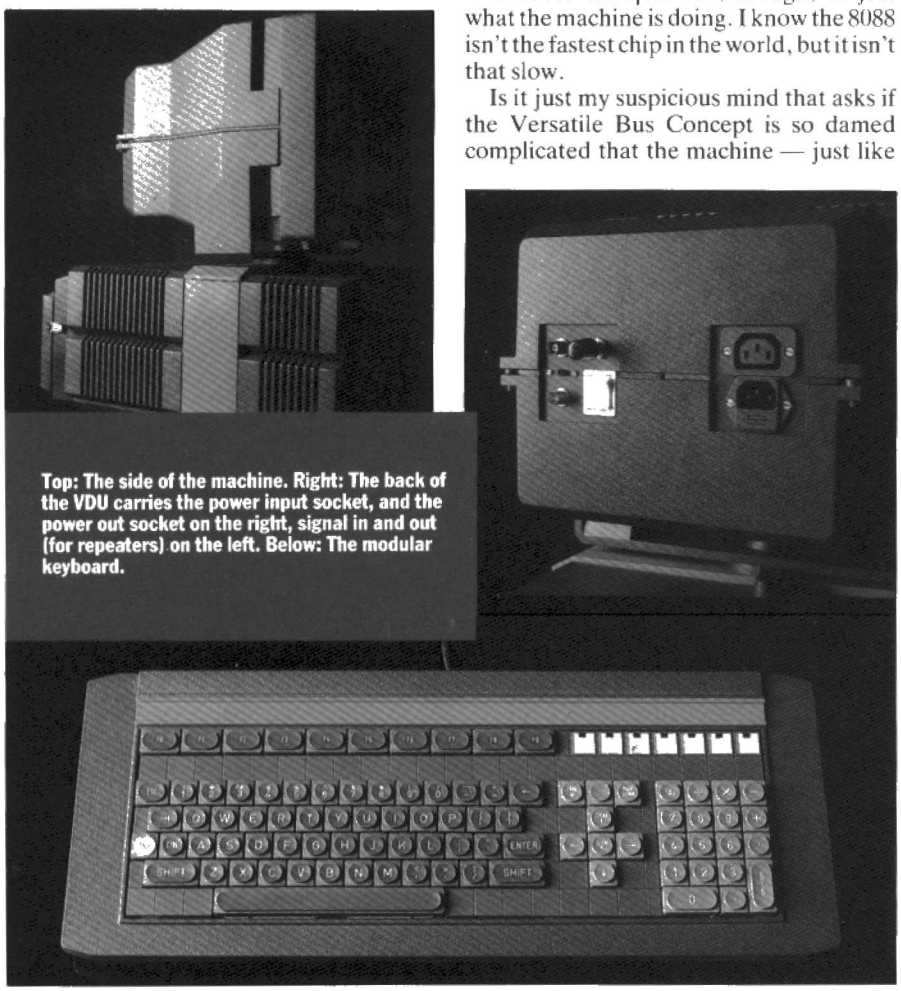
The back of the main unit looks like something my grandmother might have had in her kitchen. There's a metal cover with vents cut in it covering a large empty space. This has 12 96-way Eurocard connectors at the back and guide-rails at the sides, and this is where the various interface cards are plugged in.

These connectors are not to any recognised format or standard. Even though no documentation was provided, I can't think of any published interface definition based

on a 96-way Eurocard connector.

The cards come in single and double Eurocard sizes. On the test machine and all basic configuration Microframe 12s, the only interfaces provided are the disk controller and the VDU/keyboard controller.

The disk-control card was a 2E size but too wide, causing it to bulge noticeably, and this can't be very good for it. The VDU card was a regular 1E size, so had one side left hanging. Tycom provides 'floating' guide-rails to take care of this, propping up the empty side.



Top: The side of the machine. Right: The back of the VDU carries the power input socket, and the power out socket on the right, signal in and out (for repeaters) on the left. Below: The modular keyboard.

Connecting the keyboard and monitor cables brought on an attack of brain-fade. At first sight it seemed the plugs would be too deep for the cover, but after a while I worked it out. The cables had to be bent sharply sideways and the lid pressed firmly home.

Then I realised that I needed one hand for each cable, one or more to press the lid in, and two more to get the lever-clips, which are neatly tucked away at the very bottom of the very back of a thing that's too heavy to move.

Trying to get three people to bear on the thing and to close the lid without permanently attaching somebody to the system could be a good party-game.

Operation

The Tycom Microframe is very much a business computer, and since it runs CP/M-86, there is little that one can say about the general operation of the machine. No news is good news.

There is a point, however, at which software has less bearing on the operation than the hardware, and this is where the Microframe began to show rough edges.

There was a noticeable delay between pressing a key and seeing the letter appear on the screen — too little to time, but still noticeable. In operation it didn't seem to make any difference, but then I'm not a proper typist.

It raises the question, though, of just what the machine is doing. I know the 8088 isn't the fastest chip in the world, but it isn't that slow.

Is it just my suspicious mind that asks if the Versatile Bus Concept is so damed complicated that the machine — just like the best mainframes — is spending most of its time trying to figure out what to do next?

Verdict

So how 'future-proof' is this micro? I shouldn't think it is worth buying because it'll last, as it isn't usually the case that computers physically wear out. Making it in a foundry therefore won't help.

What about the 'upward compatibility' and expansion? I'm afraid that, as soon as anyone talks about the future of computers, I reach for my revolver.

A company suggesting it has something which will be able to use the circuits of the future as easily as those of today is asking for trouble.

At the rate of development current in chip design, it's silly to suggest that a machine purchased this year or next will be worth using in ten years, let alone supporting with new add-on products.

The time will no doubt come when technological development stabilise to this extent, but it hasn't come yet.

The simple fact is that the chip of the future probably won't work at the same currents and voltages, and even if it does, will work so much faster that the problems of making the two sorts of technology work together won't be worth solving.

The machine on sale in ten years will bear about as much resemblance to the Microframe as it will to any other machine available today — none. It'll fit in an average-sized pocket, most likely, and that will be the most obvious difference. Read a good science fiction book if you want to know more.

The Tycom Microframe is essentially a marketing exercise, and doesn't make any material contribution to the state of the art, though the admen would like you to think it did.

It does look good, and no bad thing that it should. Most computer manufacturers produce boxes which may be the embodiment of good function without achieving good design.

Apart from a slightly sluggish feel to the machine, it does the job of being a business computer quite adequately, thanks to CP/M. But this slowness in response bothers me. If it is noticeable with one user, what's it going to be like with several?

That's the problem with multi-tasking computers, and the sheer cheapness of micro-processors makes it possible to have several devoted to one user — multi-processing, in other words.

Tycom has decided to bet that the micro-computer will grow up to be a smaller version of its bigger cousins, the mini and the mainframe. I bet they're wrong.

SPECIFICATION

Price:	£2,900
Processor:	8088 at 8MHz
RAM memory:	128K expandable to 768K
ROM memory:	bootstrap
Text screen:	80 × 25, green phosphor
Graphics screen:	None
Keyboard:	Full-travel keys, qwerty layout, ten function keys, numeric keypad, cursor pad control.
Interfaces:	System bus with 96-way connectors carrying specialised interface cards.
Storage:	Two 680K 5¼in floppies.
Operating system/language:	CP/M-86
Distributor:	Tycom, 01-248 4800

PCN micropaedia

EIGHT PAGE SUPPLEMENT PULL OUT AND KEEP

GRAPHICS

Pixel power for six popular micros

Oric 1 · Spectrum · Vic-20 · Dragon 32 · Atari 800 · BBC Micro

Part 1 Volume 3

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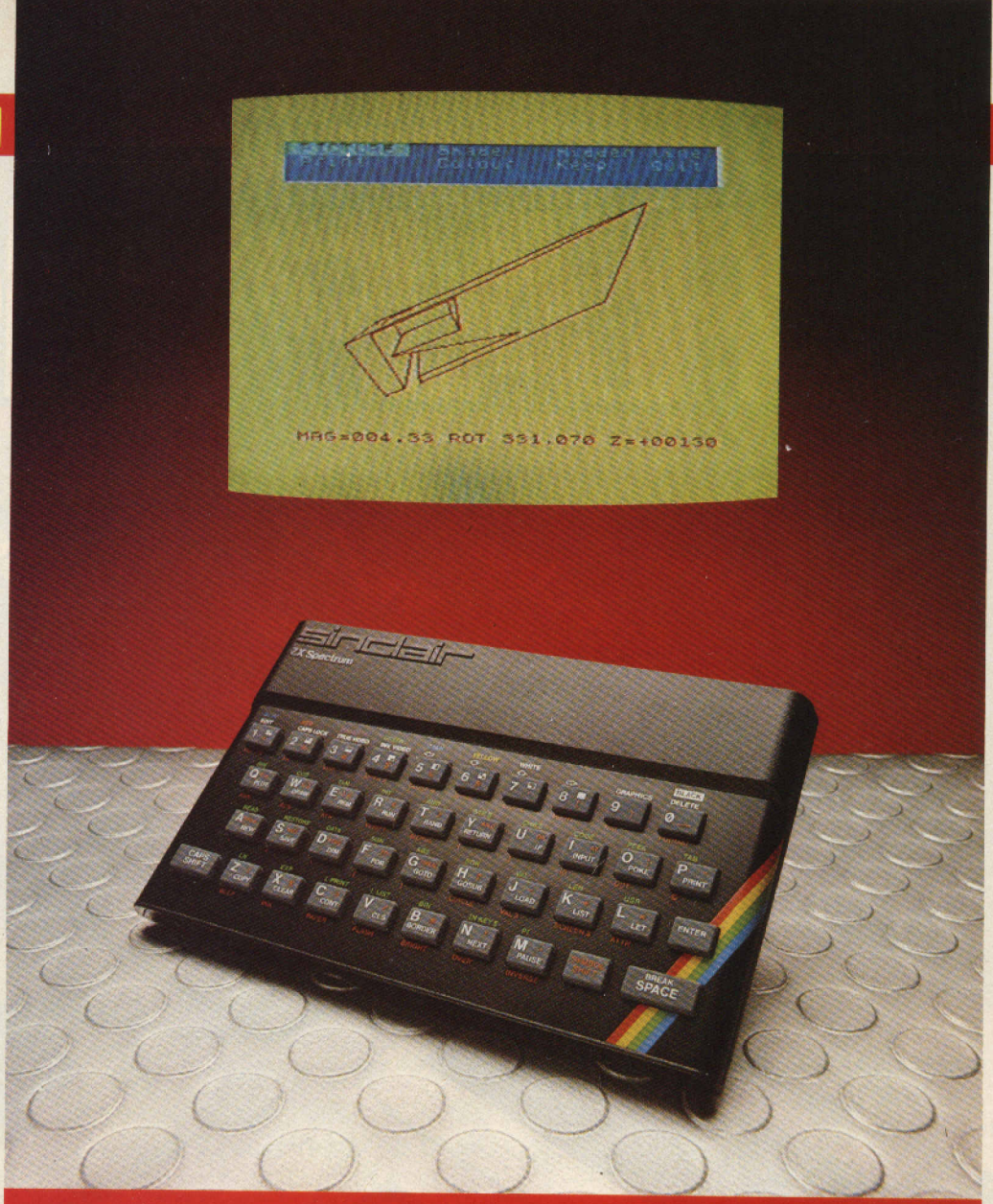


This picture was generated on a Sinclair Spectrum using the VU-3D three-dimensional graphics package from Sinclair (reviewed in *PCN*, March 18). Although this program is written in machine code, the user-defined graphics facilities and Basic of the Spectrum make it easy to create quite creditable graphics without delving into code.

SPECTRUM: COLOUR CO-ORDINATED

Finding your way with colour

The line between micros and mainframes is drawn by graphics.

For about £125, you can buy a machine to RUN programs in colour, and put you in control of what was once called an animated cartoon. Mainframes, with their punchcards, printouts and colourless arithmetic programs received none of the adoration now showered upon the micro.

In this and the next four issues of *PCN*, Micropaedia will explore graphics on six of the country's most popular machines; the Sinclair Spectrum, the Commodore Vic-20, the Dragon 32, the BBC Micro, the Oric-1 and the Atari 400/800.

Graphics form the base of most work on popular micros, whether this involves programming games, or doing computer-aided design, and they are important even for some kinds of word processing.

We'll show you how graphics on these popular machines work, how to use them and how to integrate that knowledge to use graphic tricks as aids to 'serious' programming.

Even with a spreadsheet package, colours help you divide the screen and the columns. In word-processing, colour can be used to designate different typefaces, escape codes and the definition of headers and footers.

IN 1982 Clive Sinclair launched the ZX Spectrum, a low-cost colour microcomputer. At the time it was the only micro to offer colour graphics plus sound for under £150. But in the months since then the market in low-cost micros has changed radically, with machines such as the Oric-1 and Vic-20 entering the Spectrum price-range. Though it's still way ahead. With total sales of 200,000 the Spectrum remains the largest selling colour home computer.

And the graphics play a big part in its popularity. Though as a graphics machine it has major drawbacks, for general use — whether games or business — the graphics enhance programs.

The Display

The Spectrum screen is divided into two; the paper and the border. The border surrounds the paper and you cannot print characters on it, except for error reports by the Spectrum or when input is requested.

The border can be any of the Spectrum's eight colours, and special effects can be achieved if used correctly with the paper colour. For instance, you can make the colour of the paper 'stand out' by making the border a darker colour than the main part of the screen.

When software is LOADed or SAVEd, bands of colour in the border area indicate that SAVE/LOAD is in progress. One reason why printing or plotting is not allowed on the border is because the amount of warping increases as characters near the physical edge of the screen.

The main area for printing or plotting is the paper area. You have 22 rows by 32 columns to print or plot thus giving 704 positions to print characters such as 'A', 'a' etc. Besides normal characters, such as the alphabet, there are 16 'chunky' graphic symbols, and you can define your own if these are not suitable.

Each character is made up of pixels (picture elements). One character consists of eight by eight pixels. On Spectrums these pixels can be individually plotted to give 256 horizontal and 176 vertical plottable positions — a total of 45,056 plottable positions. While this resolution is not as good as that of other

micros, such as the BBC, it enables circles to be drawn and look like circles.

Colour Commands

The background colour of the Spectrum screen can be set by the PAPER command, and the foreground colour can be set by the INK command. These statements set colour parameters locally or generally. To make the background green you enter as a direct command or in a line of code:

PAPER 4 : CLS

This would change the *whole* of the screen to green. A similar thing can be done with the INK command. To print all characters in yellow ink you enter INK 6 as either a direct command or in a program.

On the other hand, PAPER and INK can be used locally in individual PRINT statements, best demonstrated by the following examples. First, with PAPER enter the following:

```
10 PAPER 0 : CLS
20 FOR a = 0 to 7
30 PRINT PAPER a; "          "
40 NEXT a
```

When run, this program will turn the colour of the screen to black, then print eight bands of different colours.

Now for the INK:

```
10 LET a$ = "COLOUR"
20 PAPER 0 : CLS
30 FOR c = 1 TO LEN a$
40 PRINT INK c; a$ (c);
50 NEXT c
```

This program will make the display go black and print the word 'colour' with each letter a different colour.

This flexibility enables you to produce interesting screen displays, although too much use of different colours can be messy.

For bar charts and histograms, use of the Spectrum's 'chunky' symbolic graphics is normally good enough. As shown, the background and foreground colours of the graphic symbol can be set, but if finer lines are needed then the statements PLOT, DRAW and CIRCLE are used.

The most common method of plotting on most micros is the plot statement, which usually has two arguments — the horizontal and vertical positions of the screen on which the 'dot' is to be plotted. A further argument can be used with the Spectrum to specify the colour of the dot. Thus the syntax of the statement is :

PLOT c;x,y

where: c is a command which uses colours from 0 to 7, and x and y are the vertical and horizontal plot positions, which must be positive.

If a colour is not specified, the colour of the plotted pixel will be the existing INK colour. On its own, the plot statement is not much use, but in a FOR . . . NEXT loop, graphs and so on can be plotted in colour. The following program shows a plot of the function SIN, modified from the Spectrum manual example:

```
10 PAPER INT (RND*8) : CLS
20 FOR n=0 TO 255
30 PLOT INK 9;n,88+80*SIN (n/128*PI)
40 NEXT n
50 GO TO 10
```

The colour for INK in line 30 is 9; although colours are available numbered 0 to 7, two more numbers can be used with the INK and PAPER statements.

If 8 is given for a paper colour then any character printed will have its paper colour the same as it was before.

If 9 is given for a PAPER or INK statement then the colours of the ink or paper will be made to contrast. For instance, if the paper was black and the ink 9, the ink would be white. In the program shown, the paper colour is set at random and the graph is always plotted in an ink colour that contrasts with the paper colour.

DRAW enables straight lines to be drawn between two points, normally with the syntax DRAW x,y where x and y are the finishing places for the line. The starting place is the last PLOT, DRAW or CIRCLE. All these statements except PLOT are relative to each other, for example: if the last PLOT was at position 0,0 and a subsequent DRAW 5,5 was made then a line would be drawn from the bottom left pixel (0,0) to the fifth pixel from the left and five pixels from the bottom.

But, if a further DRAW 0,5 was made then a line would be drawn zero places to the right of the end of the last line and five places up from the end of the last line. Thus in real terms the end of the second line would be 5,10, *not* 0,5.

DRAW on its own gives the length and direction of the line; PLOT, DRAW and CIRCLE give its starting place.

Another variant of the DRAW is DRAW x,y,a where x and y determine the finishing place of the line, but a is the number of radians the line must turn through, thus making it possible to DRAW parts of circles or arcs.

Circles can be drawn using the PLOT statement and a bit of maths, or by using the Spectrum's CIRCLE command in the form CIRCLE x,y,r, where x and y are the co-ordinates, and r is the radius of the circle. The centre of the circle determined by x and y is also relative to the last PLOT, DRAW or CIRCLE.

PLOT, CIRCLE and DRAW can normally be mixed with other commands to determine foreground and background colours, just like ordinary characters are with INK and PAPER.

The table below describes the Spectrum's colour statements, what they do and how you can use them to get background, foreground and border colours. Since these are statements specific to the Spectrum, they are easy to use and install in any program involving graphics.

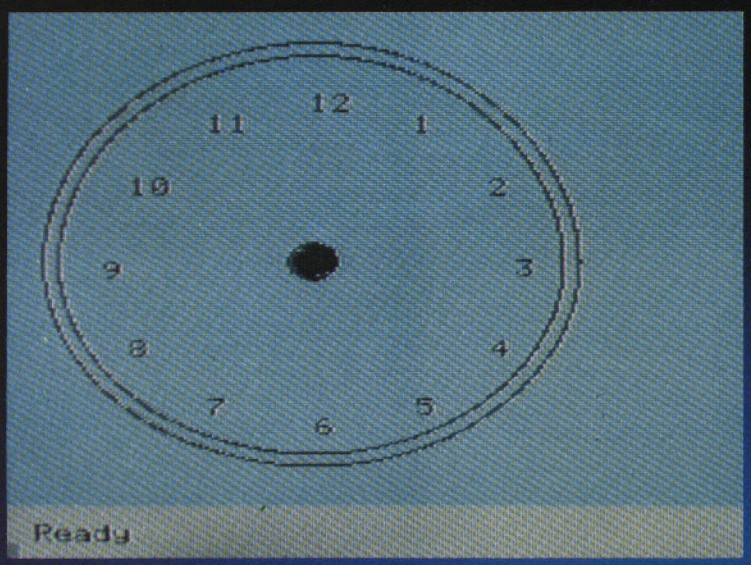
Table 1: Spectrum's colour statements

Statement	Brief description
INK n	Sets the foreground colour of characters n in the range 0 to 7.
PAPER n	Sets the background colour of characters n in range 0 to 7.
FLASH n	Defines whether characters will flash or be steady. 0=steady, 1=flash
BRIGHT n	Sets brightness of characters. 0=normal, 1=bright.
INVERSE n	Controls inversion of characters. n=0, characters are normal video; n=1, characters are inversed.
OVER n	Controls overprinting of characters. n=0, characters overwrite previous characters (normal). n=1, new characters mix with old so H over I becomes ⊞
BORDER n	Sets colour of border of screen. n in range 0 to 7.

Table 2: Spectrum's graphical statements.

Statement	Brief description
PLOT a,b,c	Prints dot with colour a at position b,c on the screen.
DRAW x,y.	Draws a line from the current plot position to y
CIRCLE x,y,z.	Draws a circle whose centre is x,y and radius z
Function	**Brief description**
POINT (x,y)	Tells whether a pixel is ink or paper colour.

TIME WITH ORIC 1



The Oric-1 has two forms of graphics — low resolution and high resolution. The former operates in the modes TEXT, LORES 1 and LORES 0, while HIRES is needed for the latter.

The different resolutions have their own set of instructions.

A screen display of 39 × 27 is available in TEXT, LORES 1 and LORES 0 modes. The x-axis runs from 0 to 38 and the y-axis from 0 to 26, with the screen origin in the top left corner.

In memory, addresses 48,000 to 49,119 correspond to this area, and anything POKEd into this section of memory will influence what appears on the screen.

Quick mental arithmetic confirms there are 1,120 addresses, but only 39 × 27 = 1053 screen positions. What has happened to the rest is explained by the fact that in these modes the top line of the screen is reserved for Oric messages, such as CAPS to indicate you are using upper case or Searching, when a program is to be LOADed from cassette. The leftmost column is also used by the Oric to define the colour of lines on the screen. Thus there are, in effect, 40 × 28 screen positions, giving 1,120.

To prove this, switch on the Oric (it comes on in TEXT mode) and try:—

```
POKE 48008,48
POKE 49119,48
```

The number 48 is the ASCII code for 0, and the effect of the first command is to display a 0 at the top left of the screen, while the second command displays a 0 at the bottom right.

Fortunately, you are not limited to POKE to get information on the screen in low resolution modes.

The instructions PRINT and PLOT can be used, but they are limited to affecting the 39 × 27 display — only POKE reaches the parts other instructions cannot reach.

The PRINT statement follows the Microsoft standard, thus:—

PRINT <list of expressions separated by ; or ,>

It does, however, have a useful variant by combining it with the CHR$ function to print special characters controlling the cursor position, eg CHR$(8) causes the print position to move left and CHR$(11) causes it to move up.

PLOT has the form:

PLOT x,y,<expression>

where x and y give the starting screen position and <expression> is the item to be printed, either text in quotes or an ASCII value.

As well as displaying actual data on the screen, the POKE, PRINT and PLOT instructions can affect the colours or height of other displayed characters and whether they flash or are steady. This is because the Oric uses serial attributes to control its screen, whether low resolution or high resolution. An attribute character placed on a line is invisible but affects the way in which the rest of the information on that line is displayed. The colours available are denoted 0 to 7 and are black, red, green, yellow, blue, magenta, cyan and white respectively.

Attribute characters have ASCII codes between 0 and 31, and some examples are:

0 — 7	foreground colours 0 — 7
16 — 23	background colours 0 — 7
9	alternate character set
10	double height character
12	flashing
24	60 Hz display

The latter is particularly interesting since it affects the TV modulator and changes the screen synchronisation to the American standard: the net effect on a UK set is fuzzy lines.

To try out the foreground colour attributes, enter the following:

```
10 CLS: PAPER 7: INK 0: PLOT 10,5,
"BBRRGGYYBBMMCCWW"
20 WAIT 500
30 FOR A=0 TO 7
40: PLOT 10+2*A,5,A
50 NEXT A
```

Lines 30 to 50 overwrite alternate letters with colour attributes so that all eight foreground colours appear. Since colour 7 is white, it is not visible on a white background.

In addition, there are three other facilities available in low resolution displays, INK, PAPER and the SCRN function.

INK defines the foreground colour, while PAPER defines the background colour. The colours are specified by the numbers 0 to 7. Both INK and PAPER set attribute characters at the beginning of each screen line. For example, if we look at the addresses 48040 and 48041, the first two positions of the first screen line:

```
10 PAPER 7: INK 0
20 PRINT PEEK(48040),PEEK(48041)
30 PAPER 6: INK 1
40 PRINT PEEK(48040),PEEK(48041)
```

Notice how the background attributes stored in the first position changes from 23 to 22 and the foreground attribute stored in the second position changes from 0 to 1.

The SCRN function provides us with a way of discovering what character is on the screen at a given position. For example

PRINT SCRN(X,Y)

prints the ASCII value of the character at the screen position (x,y), whether it is an attribute character or a normal displayed character.

Entering HIRES mode on the Oric causes the screen to go black, apart from the bottom three lines. Using PRINT causes the printed information to be displayed in the bottom three-line window, whereas PLOT does not work at all. PAPER and INK give the same result as in low resolution modes. There are, however, several specialised high resolution instructions.

First a look at the screen and memory layout. HIRES makes available a grid of 240 × 200 positions, with the y-axis from 0 to 199 downwards and the x-axis from 0 to 239. There is no top line for system messages (don't try cassette commands in HIRES), and all columns are accessible. The corresponding memory area is addresses 40960 to 49119.

There are 40 memory locations for each of the 200 lines and a location can hold an attribute or a pattern. If a pattern is held it is in the last six bits, thus giving 40 × 6 = 240 horizontal positions.

Many of the HIRES instructions are similar to those on other machines, but a list is given here.

The table below lists some of the high-resolution instructions used on the Oric that are similar to those used on other popular micros. The program listed on this page uses some of those commands to draw the clock face on the left.

CURSET X,Y,FB	moves the cursor to position (x,y) and displays the cursor according to the FB number: 1 = background 2 = foreground 3 = inverted 4 = not displayed
CURMOV X,Y,FB	moves the cursor +x and +y relative to its previous position. FB as in CURSET
DRAW X,Y,FB	draws a line from the cursor's current position to a position +x,+y relative to it. FB as in CURSET
PATTERN N	defines the pattern for the line drawn by DRAW according to the binary pattern of N
CHAR C,M,FB	displays a character whose ASCII value is C at the current position. M indicates the mode of display, 0 being standard characters, 1 being alternate
CIRCLE R,FB	draws a circle, centered on the current position, radius R.
FILL R,C,A	puts the ASCII value A in R rows and C cells (ie memory locations). R is 1 — 200, C is 1 — 40.
POINT(X,Y)	a function which returns a value of 0 if the position (x,y) is in background colour, or 1 if it is foreground

The accompanying program demonstrates some of the above instructions by drawing a clock face.

```
105 REM Initialise
110 HIRES
120 PAPER 6:INK 1
130 CURSET 100,100,3
135 REM Draw centre
140 FOR R=1 TO 8:CIRCLE R,1:NEXT R
145 REM Draw border
150 CIRCLE 80,1
160 CIRCLE 85,1
165 REM Draw numbers I = 1 ... 12
170 I=1
180 REPEAT
190 :N=48+I
200 :A=(9+I)/6*PI
210 :CURSET 100,100,3
220 :CURMOV 65*COS(A),65*SIN(A),3
230 :IF N<58 THEN CHAR N,0,1 ELSE CHAR 49,0,1:CURMOV 7,0,3:CHAR N-10,0,1

240 :I=I+1
250 UNTIL I>12
```

ART OF THE ATARI

The Atari 800 and its less-sophisticated sibling the Atari 400 stand as two of the most highly developed colour graphics home micros. The 800 not only takes all of Atari's high-resolution cartridge software, but can also operate with disks and cassettes.

The ability to redefine characters is one of the many things that makes many micros so versatile. The Atari is no exception.

The Atari's character set contains 128 characters plus a further 128 'inverse' (black on white instead of white on black) forms of them. Each character takes up 8 bytes of memory, so a full set requires 1,024 bytes or 1K of memory for storage.

The Atari has a character set stored in its 10K ROM which goes into a reserved area of memory when the computer is switched on. The computer 'looks' at this area of memory to display characters on the video screen, and is told in which 'pages' of memory to find the characters by a value in location 756.

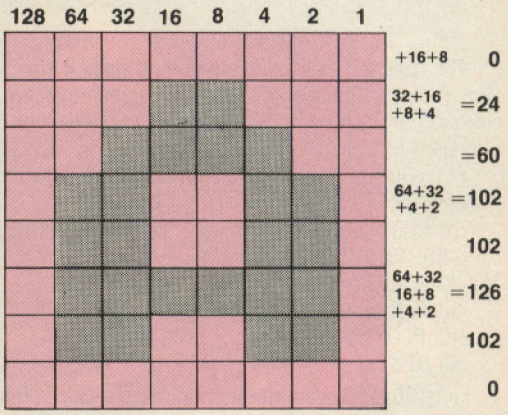
This value is set by the computer at 224 whenever the Atari is switched on, when SYSTEM RESET is pressed or when a graphics mode is selected.

In order to use your own characters you must first define your set in RAM and then change the pointer at 756 to the area of memory within which your character set is located.

Each character is displayed on an 8×8 grid. Each horizontal line of the grid represents 1 byte of memory, which can store a value between 0 and 255. The value of each of the 8 dots represented by the first byte is shown below:

128	64	32	16	8	4	2	1

Any number between 0 and 255 will produce a unique sequence of dots (*ie* 256 possible dot combinations). When the computer displays a character it reads the character's 8-byte code and translates each byte into a line of dots according to the above rules. Therefore a complete character is made up as follows:



The 8-byte code for the letter 'A' will consequently be 0,24,60,102,102,126,102,0

The first thing to do when making your own character set is to duplicate the existing Atari set into your own area of memory. This is done in lines 1000 to 1030 in the program.

First put the character set 1K (8 pages @ 256 bytes/page) from the top of memory. The computer won't use this area of memory unless the program gets very long.

Location 106 contains the number of free pages of memory in the computer. If you don't duplicate the character set in this way the computer would not find the alphabet there when character sets are switched. The effect of switching character sets is instant and will affect anything already on the screen.

The number of a character's position in the character set is not the same as its ATASCII value. The characters are in a different sequence, outlined as follows:—

A new cast of characters

```
10 GRAPHICS 0:POKE 82,2:POKE 83,39:? "PLEASE WAIT":GOSUB 1000
20 ? :? "1. REDEFINED CHARACTERS FOR ANIMATION"
30 ? :? "2. REDEFINED CHARACTERS FOR LANDSCAPE"
40 ? :? "3. REDEFINED CHARACTERS FOR LANGUAGES"
50 POKE 764,255:? :? "CHOOSE 1-3";:TRAP 50:INPUT A:IF A<1 OR A>3 THEN 50
60 GOSUB (A+1)*100
70 GOSUB 2000:GOTO 20
80 ? :? "3. REDEFINED CHARACTERS FOR LANGUAGES"
100 POKE 764,255:? :? "CHOOSE 1-3";:TRAP 100:INPUT A:IF A<1 OR A>3 THEN 100
110 GOSUB (A+1)*100
120 GOSUB 2000:GOTO 60
200 REM ANIMATION CAPITALS START AT POSITION 65 LOWER CASE START AT 97
210 RESTORE 220:FOR LOOP=1 TO 32:READ A:POKE (RDSET*256)+(33*8)+LOOP-1,A:NEXT LOOP
220 FOR LOOP=1 TO 8:READ A:POKE (RDSET*256)+(64*8)+LOOP-1,A:NEXT LOOP
225 FOR LOOP=1 TO 32:READ A:POKE (RDSET*256)+(97*8)+LOOP-1,A:NEXT LOOP
230 DATA 3,15,16,32,76,82,204,193,192,240,8,4,98,146,99,3,193,193,64,68,35,16,15,3,131,131,2,34,196,8,240,192
231 DATA 0,0,0,0,0,0,0,0
232 DATA 3,15,16,32,64,82,204,193,192,240,8,4,2,146,99,19,193,193,64,67,36,16,15,3,131,147,2,194,36,8,240,192
240 POKE 764,255:GRAPHICS 18:? #6:? #6:? #6;" AB ab AB ab":? #6;" CD cd CD cd"
250 POKE 756,RDSET:FOR LOOP=1 TO 250:NEXT LOOP:POKE 756,RDSET+2:FOR LOOP=1 TO 250:NEXT LOOP
260 IF PEEK(764)<>255 THEN RETURN
270 GOTO 250
300 REM LANDSCAPE
310 RESTORE 320:FOR LOOP=1 TO 72:READ A:POKE (RDSET*256)+(33*8)+LOOP-1,A:NEXT LOOP
320 DATA 255,255,255,255,255,255,255,255,0,0,0,60,66,129,0,0,3,15,31,63,127,127,255,255,192,240,248,252,254,254
330 DATA 255,255,24,60,127,127,255,255,255,127,97,247,255,255,255,255,255,255,128,88,252,252,255,255,255,254,255
340 DATA 127,63,125,125,121,49,0,255,254,252,254,255,190,12,0
350 GRAPHICS 18:POKE 756,RDSET:POKE 708,225:POKE 709,11:POKE 710,180:POKE 764,255
360 ? #6:? #6
370 ? #6;"                bb "
372 ? #6:? #6;"EFG  bb    "
374 ? #6;"HAI"
376 ? #6;" A     EFG"
378 ? #6;" A     HAI"
380 ? #6;"CAD     A         CA";
382 ? #6;"AAAD   EA   CAD  CAA";
384 ? #6;"AAAAAAAAAAAAAADCAAA";
386 ? #6;"AAAAAAAAAAAAAAAAAAA";
390 IF PEEK(764)<>255 THEN RETURN
392 GOTO 390
400 REM LANGUAGES
410 RESTORE 420:FOR LOOP=1 TO 56:READ A:POKE (RDSET*256)+(33*8)+LOOP-1,A:NEXT LOOP
420 DATA 195,24,60,102,126,102,102,0,0,102,0,24,102,102,24,0,112,204,204,254,198,198,254,192,16,40,40,68,68,130
430 DATA 254,0,24,36,66,126,66,36,24,0,56,16,214,84,56,16,56,0,60,102,96,120,96,96,96,127
440 GRAPHICS 0:POKE 756,RDSET:POKE 764,255
450 ? :? "With redefined character sets you can write text as it should be written,  even in foreign languages:"
460 ? :? " german - A B C"
470 ? :? " greek  - D E F"
480 ? :? " even a proper english pound sign - G"
490 ? :?
495 IF PEEK(764)<>255 THEN RETURN
497 GOTO 495
1000 RDSET=PEEK(106)-8
1010 ATSET=PEEK(756)*256
1020 FOR LOOP=0 TO 1023:POKE (RDSET*256)+LOOP,PEEK(ATSET+LOOP):NEXT LOOP
1030 POKE 756,RDSET
1040 RETURN
2000 GRAPHICS 0:? "PLEASE WAIT":FOR LOOP=776 TO 880:POKE (RDSET*256)+LOOP,PEEK(ATSET+LOOP):NEXT LOOP
2010 FOR LOOP=264 TO 360:POKE (RDSET*256)+LOOP,PEEK(ATSET+LOOP):NEXT LOOP
2020 RETURN
```

When entering the program please note:

- The ' ' symbol is the clear symbol and is obtained in a program by pressing ESCape, holding down the ConTRoL key and pressing the key marked CLEAR.
- When entering letters A-D in line 240 a mixture of colours can be obtained by typing in the letters first in upper case then lower case then in inverse (Atari key) upper case then in inverse lower case. (This was done in the original program but the printer does not print inverse characters.)
- For the proper effect in lines 372-382 the letters E,F,G,H, and I should also be in inverse and the letter 'A' in line 375 and the second letter 'A' in line 378.
- Line 10 — Selects graphics mode 0, sets margin to defaults, displays courtesy message and jumps to routine at line 1000.
- Lines 20-50 displays choices and accepts choice from keyboard allowing only valid responses.
- Line 60 jumps to routine at 200, 300 or 400 depending on previous input.
- Line 70 jumps to re-initialisation routine when demos from 200-500 have finished.
- Lines 210-230 reads new characters into memory.
- Line 240 selects full screen, large character graphics, set up screen display.
- Line 250 flips between 1st and 2nd half of character set.
- Lines 260-270 returns from demo routine if any key is pressed.
- Lines 310-340 reads new characters into memory.
- Lines 350-386 selects full screen, large character graphics, sets up screen display.
- Lines 390-392 returns from demo routine if any key is pressed.
- Lines 410-430 reads new characters into memory.
- Line 440 selects ordinary character graphics mode (mode 0)
- Lines 450-490 sets up screen display.
- Lines 495-497 returns from demo routine if any key is pressed.
- Lines 1000-1040 copies Atari character set into our area of memory.
- Lines 2000-2020 replaces first few upper and lower case characters destroyed by our own set for screen clarity.

Positions 0 to 63 = ATASCII 33 to 95
Positions 64 to 95 = ATASCII 0 to 32
Positions 96 to 127 = ATASCII 96 to 127

To redefine 'A' involves the area of memory between the beginning of your character set + 33×8 ('A' is the 34th character in the set) to the beginning of your set +33×8+8.

Now decide on a character — fill in a grid and determine the 8 values corresponding to the values of the letter. Then POKE these values into the area of memory designated for the letter 'A'.

The most obvious use of character sets is in games. In Atari's own 'Space Invaders', the invaders are characters. By switching them quickly, the invaders are animated, made easier since there are only six different monsters, each with four different incarnations.

The ability to scroll in any direction enables many games to use redefined characters to display maps (as in 'Legionnaire') or for a layout such as that in 'Sea Dragon', a spin-off from Scramble-type arcade games.

Character graphics can also save memory. Using characters to define a high resolution screen can save up to 90 per cent of the memory that would be used by its equivalent graphics mode.

The uses of redefined character sets is almost as limitless as the variation of characters that can be created.

The demonstration program will give you some ideas.

SIX-PACK SPEX

Contributors: Richard Hawes, David Janda, Bob Maunder, Geof Wheelwright

NEXT WEEK

Programming hints for the Vic-20, the Dragon 32 and the BBC Micro, plus an overall look at the pixel power of these machines.

And in two weeks an in-depth look at specific graphic applications for our six popular micros, with user-defined graphic tips for the Spectrum and BBC and more high-resolution hints for the Atari. Let's see the colour of your computer.

				RAM		DISPLAY			
MODEL	COST	PROCESSOR	SPEED	STANDARD	EXPANDED	COLS v. LINES	DOT RESOLUTION	STORAGE	INFORMATION
ORIC-1	£99	6502A	1MHz	16K	48K	40 × 28	240 × 200	Cassette	Calculator-style Keyboard
SPECTRUM	£125	Z80A	3.5MHz	16K	48K	32 × 24	256 × 192	Cassette	Calculator-style Keyboard
VIC-20	£170	6502	1MHz	5K	32K	22 × 23	176 × 158	Cassette	4 function keys 3 expansion slots Disk system optional
DRAGON 32	£200	6809E	1MHz	32K	64K	32 × 16	256 × 192	Cassette	Full-travel keyboard
BBC MODEL B	£399	6502	2MHz	32K		80 × 24	640 × 256	Cassette Disk	10 Programmable function keys Teletext facility
ATARI 800	£400	6502	1.8MHz	16K	48K	40 × 24	320 × 192	Cassette	Full-travel keyboard disk system optional

IBM's original in retrospect

Deenagh Brook revels in some of the finer details of the classic business micro.

The IBM PC, launched early this year and apparently selling smugly beyond its makers' expectations, makes an interesting contrast to the Tycom Microframe.

It arrived as the progenitor of a whole new concept in computer design, its significance lying in the fact that it was aimed squarely at the business user, not the hobbyist or programmer.

Both the Tycom Microframe and the IBM PC are marketed in the full sense of the word, but the IBM is being sold in a very different way.

The European model has fewer improvements on the US version than anticipated but, knowing IBM, this will not be the case for long as it is renowned for continuously upgrading all its machines.

Presentation

The machine is designed to be an 'open' computer; it can be configured to the user's requirements. Memory is expandable up to 576K.

The system consists of separate units, and each comes extremely well packaged in boxes which describe the contents either with a label or pictorially. A nice touch is the detailed way in which IBM describes in the manual supplied how to package the machine for re-location.

The first impression of the computer is that it is a quality product, sleek-looking and well-finished. Power leads are included with each unit, with moulded plugs appropriate to the country in which it is sold. Also included are the connecting leads for each unit to the main system unit.

The keyboard is separate and connects to the system unit by a coiled lead. A monitor can sit securely on top, making a compact unit.

Documentation

The *Guide to Operations* manual delivered with the computer is a dream in terms of presentation, clarity and the thoroughness with which it has been thought out and put together. It is divided into clear sections and, where necessary, directs the user to another section in the manual.

All the way through the book there are step-by-step instructions with drawings and examples; in fact, it resembles a very well defined flow-chart in its detail without patronising.

Getting started is therefore easy. When turned on the computer performs a self-diagnosis and comes up with a message if, for example, the keyboard isn't connected.

The manual explains precisely what should happen; that is, the LED light on the disk should light up before the bleep on the main unit. If it doesn't then the user is directed step-by-step towards probable causes of this fault.

A useful section on problem diagnostics is included, as well as detailed instructions on how to install options available.

Construction

The Personal Computer is designed around the main system unit, which houses the disk drives and the usual logic circuits.

The screen can be bought separately, and the one sold by IBM is of high quality and capable of handling high resolution graphics with clarity and stability. (Nothing is more aggravating than to have a detailed picture on the screen wavering all over the place). It is buffer controlled and an address in storage which is held on the VDU adaptor card holds the screen image.

As there are different address ranges for the colour and the black-and-white screens it is possible to run both a black-and-white and a colour VDU at the same time, giving

opportunities for extremely good animation effects.

Keyboard

The keyboard on the IBM PC deserves special mention; it is easy to see why it is IBM's pride and joy, even though there are a few minor irritations for new users but still its quality shows. It is light enough to move easily, but heavy enough to make it feel secure.

Two little legs at the back swivel into place to change the angle. The Germans insist that the G and H keys are a precise distance above the surface on which the keyboard is placed, which is why these legs are there.

The keys are coloured in either grey or white; white indicates the standard typewriter keys and the grey ones are the special keys such as function, numeric, and attribute.

An improvement over a normal typewriter is the fact that if the CAPS LOCK key is on, the numbers still come out as numbers. Only in upper shift mode does one get the symbols such as $ and @.

There are at first sight ten special function keys, but by clever use of the ALT, CONTROL and UPPER CASE shifts these function keys can produce 40 options. The function keys are easy to program (explained thoroughly in the Basic manual supplied), using the KEY statement in Basic.

Typing KEY 3, HELLO would cause the computer to display HELLO on the screen every time function key number 3 is depressed.

The format is KEY,n,x$ and x$ can be up to 15 characters long.

To display the functions assigned to each key, one simply has to type KEY ON or KEY LIST. In Basic, common Basic commands can be set up by using the ALT key with one of the normal keys, such as ALT I for INPUT, or ALT F for FOR.

To the right of the keyboard are the numeric keys, which double up as cursor control keys when the NUMERIC LOCK is not on. It can be a little confusing for the new user to remember to put this NUMERIC LOCK on when using these keys as a numeric pad, but use of the UPPER CASE key turns off the NUMERIC LOCK temporarily.

The PRINT SCREEN key, though, is nice to have. It is so useful to be able to get a screen dump at the drop of a hat, without needing special piece of software.

The CTRL and BREAK keys can be particularly useful when running or listing programs. Using the keys together allows exit from Basic. In Basic, the ESC key clears the screen.

Depressing the CTRL and NUM LOCK keys causes a temporary stop, useful when listing or printing, which continues until any key other than the SHIFT, BREAK, and INS keys are pressed.

Storage handling

Storage can be on cassette or disk; There is an option to have one or two floppy disk drives with either 160K or 320K or a mixture of both. Installing disk drives is explained in great detail, and is easy to do.

One of the criticisms levelled at IBM at the moment is that the capacity of these drives is low in comparison to those of competitors. It is interesting to note, therefore, that on the back of the machine there is an extra plug which is not mentioned in the current manual but looks as though it could be for a disk drive.

The disk operating system includes an option to create backup disks when there is only one drive present.

Expansion

There are five expansion slots inside the system unit which are used for extra memory boards, communications adaptors, game control adaptor, diskette drive adaptor, colour graphics adaptor and so on.

These are easy to get at; the internal workings of the system unit are exposed by undoing two screws and sliding off the casing.

Improvements over the US PC are memory expansion boards that can hold 64K of memory as opposed to 16K, in 16K chips, and an extra expansion slot. Another improvement is that the basic system in the European model comes with 64K RAM.

There are two sets of switches inside the system unit that have to be set differently according to add-ons being used. An advanced diagnostic kit is available which makes fault-identification seem like child's play, so maintenance of this machine ought to be very good.

Operation

The operating system is in ROM, and includes start-up diagnostics and the lowest of three levels of Basic. So, on booting the machine, you have instant access to Basic.

The disk operating system comes at a small extra charge. A comprehensive manual describes the DOS utilities in detail.

A useful utility for a European machine

48▶

Peter Smith

Above: The back of the main unit has the fan outlet, keyboard, and cassette connectors and user-installed interfaces. Below: The Keyboard is to the ISO standard, but some people may dislike the small Shift keys.

is the creation of a national DOS disk from the master disk, which sets the keyboard up for the basic European languages automatically.

Programming languages available are Basic, Fortran, Pascal, Cobol and Assembler.

'The IBM PC is expensive, but a Rolls Royce costs more than a Metro'

IBM has divided Basic into three levels, one resident in ROM, the second referred to as Advanced Basic within DOS, and the third available for use with the colour/graphics monitor adaptor.

A comprehensive manual takes one through the options available in Basic and states at what level it is in use. With the DOS diskette comes a diskette of sample programs.

Use of the graphics adaptor enables you to obtain medium and high resolution on the screen. Selection is made by using the SCREEN statement, while other statements used for graphics in Basic are CIRCLE, PAINT, COLOR, DRAW, GET, LINE, PRESET, PSET and PUT. Basic will support statements for control of a light pen, joy sticks, and sound.

The statement SOUND makes a single sound of given frequency and duration and PLAY plays music as indicated by a character string.

Editing can be done either within a line as it is being entered, using the DOS editing keys, or on complete lines within a file using the EDLIN program. Special editing rules can be defined when using the Basic program editor.

Maintenance

Maintenance of the PC is supported by IBM and can be undertaken either by the company, its authorised dealers or by third-party agreements. All units are under warranty for parts and labour for six months.

Support

User queries should be directed to the dealer from whom the machine was bought and the dealers have a hot-line to a special department at IBM's Basingstoke offices.

Overview

To set up a configuration comparable to those of its rivals, the IBM PC is marginally more expensive at £4,940 (including VAT), but then a Rolls Royce is a lot more expensive than a Mini Metro. Given that it is beautifully simple to use from start to finish and that there is a great deal of software available for it, it must be good value for small businesses or executives in large companies.

There are going to be many enhancements for this machine, either from OEMs or from IBM itself now that it has come to Europe.

SPECIFICATION

Processor:	8088 running at 4.7MHz.
RAM Memory:	128K minimum, expandable to 576K.
ROM Memory:	40K consisting of Basic and self-checking code.
Text screen:	80 × 25
Keyboard:	83 full-travel moving keys with built-in click.
Interfaces:	Centronics parallel plus 5 expansion slots.
Storage:	360K on 5¼in floppy. Extra drives or hard disk optional.
Operating systems:	PC-DOS
Distributor:	IBM UK, (0256) 56144.

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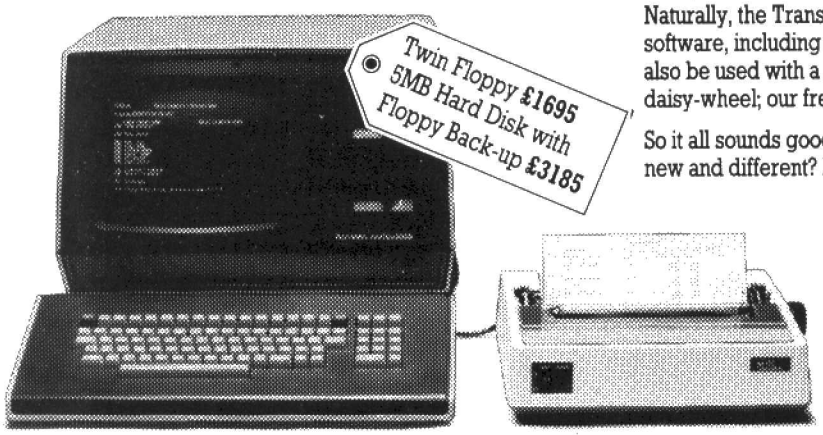

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AMAZING MAZES

Spectrum

Name Mined-out. **System** 48K Spectrum. **Price** £4.95. **Publisher** Quicksilva (0703-20169). **Format** Cassette. **Language** Basic. **Other versions** Dragon soon. **Outlets** Mail order, Boots, and most main dealers.

Oh, blast!

Everyone is fond of saying what makes for a good game, but there are no real rules. Some are simple and boring, while others are endlessly complicated — and equally boring. Some though — and Mined-Out is one of them — are simple in concept but maddeningly addictive.

Objectives

The screen becomes a minefield, and you have to move across from bottom to top. In fact, you have to crawl across nine minefields if you are to achieve the game's apparent objective of rescuing Bill the Worm; you plot your way across one square at a time using the arrow keys.

First impressions

Quicksilva's annual turnover is now fast approaching £10 million, and clearly the firm can now afford decent packaging for its games. This one is a first-class professional job and is well-designed and printed.

In play

As you make each step into the minefield, you are told how many mines are in the four squares adjacent to you, but not where they are.

The game becomes a process of deduction, and while there *should* be no logical reason why you should step on a mine and get blown to smithereens . . . well, you just try it.

You're not playing against the clock, though you do get bonuses for speed, and also for rescuing damsels in distress in later levels.

There are other complications, in that when you reach level 3 the game will be stopped from time to time if you're too slow, and a few extra mines scattered around. These new mines are at least visible, which helps, but what doesn't help in the least is the creature that appears at level 4 and which solemnly hops after you.

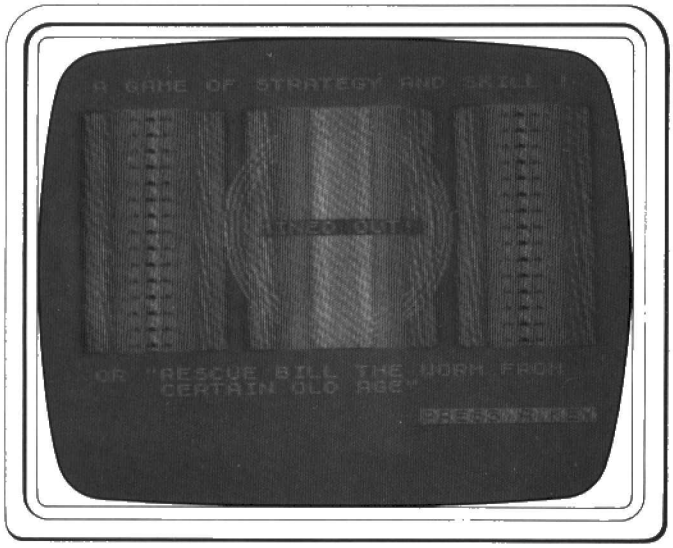
Verdict

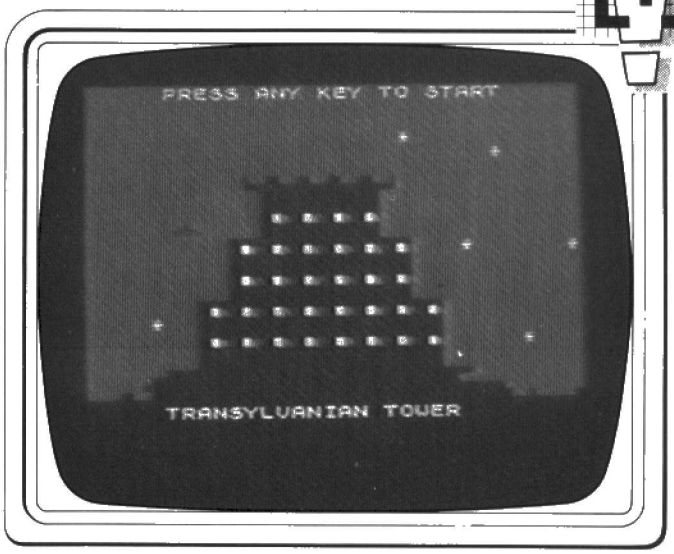
I find it impossible to fault this game, simple as it seems. The instructions are clear, and are available after every round if you want them. The graphics are effective; the sound effects are as good as you can expect from the Spectrum, if that's not an insult; there is a high-score facility, with much rejoicing when a new high is reached; there is an action-replay to show you where you went wrong.

Can you praise any game higher than by saying it's one of those where you decide you'll have just one more go, then find yourself still playing half an hour later?

Mike Gerrard

Lasting appeal —
Playability —
Use of machine —
Overall value —





Spectrum

Name Transylvanian Tower **System** 48K Spectrum **Price** £6.50 **Publisher** Richard Shepherd Software (0628-21107) **Format** Cassette **Language** Basic **Other versions** None **Outlets** Mail order, W H Smith and other dealers

Bat battle

Hot on the wheels of the original text-only Adventure games, where you merrily tapped in 'North,' 'South,' or more frequently 'Help,' have come the 3D Adventures, where you can actually see where you are, and the directions you can move in. What next, one wonders . . . being dragged from the keyboard and pushed out into the real world?

I for one don't want to get any closer to a Transylvanian dungeon than this simulation, thank you very much.

Objectives

Each of the five floors of the tower in this game is made up of a hundred rooms. Naturally, you start in the dungeon, on the bottom floor, and as far from the exit as possible.

On this first level there are no objects to hunt for, and no bats or other nasties to fend off, so it's a good way of getting used to the movements you make with the arrow keys.

Your objective is to make your way safely up to the fifth level for your encounter with Count Kreepie who bears a startling resemblance to Sir Keith Joseph, so this is not recommended to those of a nervous disposition.

First impressions

As with most games of this type, the instructions are fairly detailed. But everything is fully explained on the cassette insert, and then again on the screen when the tape is LOADed.

In play

Once you've been set down in the dungeon you use the arrow keys to take you from room to room through whichever dark door you choose. The '6' key will turn you through 90 degrees, so pressing it twice turns you round completely.

But it's only when you get out of the dungeon that your troubles really begin. You start finding objects, such as garlic, a cloak, a dagger and a sword, and can carry up to three of these, but you also begin to encounter bats, which flit about the top of the room while you try to shoot them down.

You could easily leave them and move on to the next room, but in the first place only bats carry maps from here on in, and in the second place you have to kill a certain number before you can move to the next floor. If you reach the exit without the required tally of dead bats, you'll be moved back to a random room on the same level. This is not a good thing.

Verdict

Transylvanian Tower is an excellent game at a reasonable price, and should stand the test of repeated playings, despite the drawback of the slow maze construction. I couldn't progress beyond Level 3, where I was seen off by an unexpected vampire while I wasn't carrying a clove of garlic. **Mike Gerrard**

RATING
Lasting appeal —
Playability —
Use of machine —
Overall value —

SCIENCE FICTION

APPLE II

Game for a laugh

Name Lunar Leeper **Application** Science fiction **System** Apple II **Publisher** Sierra Vision **Format** disk **Language** Machine code **Outlets** SBD Software 01-870 9275 **Price** £19.95

What a relief to play a game, get absolutely thrashed, collapse in heaps of laughter and then have another attempt . . . then another . . . and another . . .

If you happen to be like me, you'll laugh at the wrong times and forget what you're doing. It gives the program an extra advantage as you laugh away another life.

Objective

There you are in your little spaceship high above the moon, running out of fuel. Your shipmates have somehow contrived to be stranded on the surface.

All you have to do is pick them up — by the head! Easy, you think. Well, it would be if only the Lunar Leepers with their voracious appetites would stop eating the castaways and spaceship.

Once you have completed this task, stage two commences. Your mission: to boldly go where no spaceship should ever be and ('Perisher' fanatics will love this) shoot the eyeball in the sky.

As luck would have it, the eyeball is at the end of a cave defended by Trabants, but they should really have been crabs!

First impressions

I am wary of glossy boxes bearing strange illustrations, in this case a red cycloptic blob contriving to avoid/eat a spaceship. The game is on one disk with accompanying fold-over instruction card.

The instructions are brief but accurate and the game allows a keyboard, joystick or Atari joyport options for controls. If the keyboard is selected the player is asked to define which keys are to be used during play. Once into the game the graphics and sound are excellent.

In play

Starting at level one (easiest) of eight, the play is relatively easy, as long as you suppress the odd chortle. In fact, it's worth making a few mistakes just to see the results. As you move up through the levels, more Leepers and spaceship-like Trabants hinder your mission.

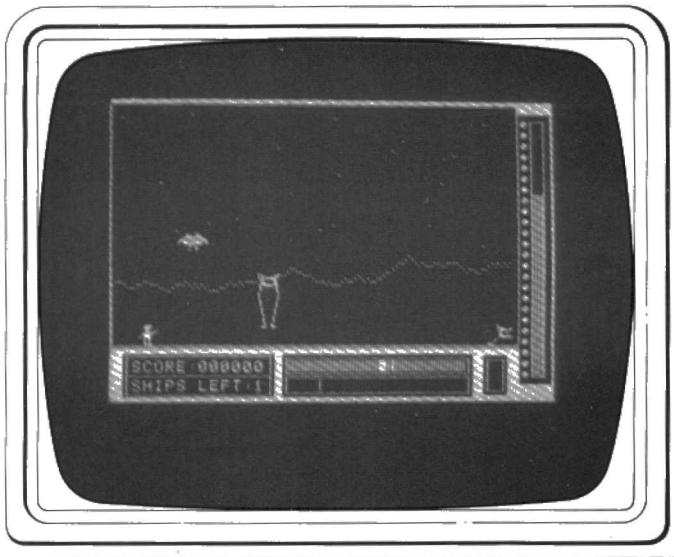
Eventually, Trabants start appearing in stage one with the added problem that they are unkillable. Unfair this might be, but it definitely increases the excitement.

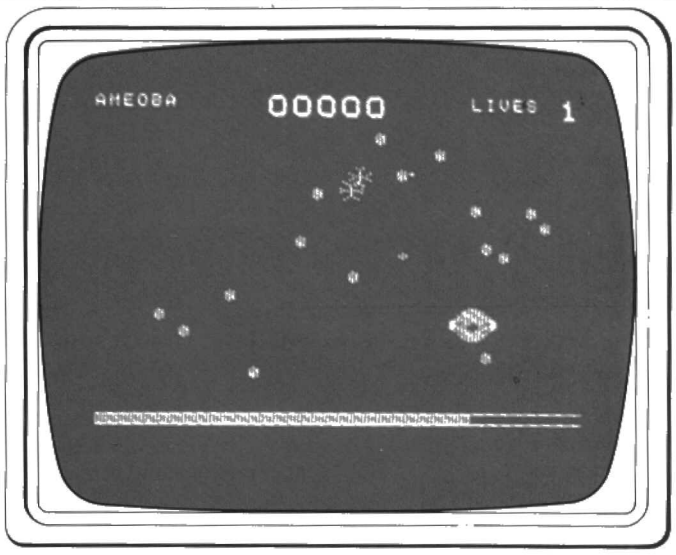
Verdict

I so thoroughly enjoyed this game I assumed I was being biased. However, I coerced a couple of non-game players to have a go. Result — addiction. Need I say more?

Nigel Cross

RATING
Lasting appeal — 5
Playability — 5
Use of machine — 5
Overall — 5





APPLE II

Test of survival

Name Evolution **Application** Science Fiction **System** Apple II **Publisher** Sydney Development Corporation **Format** disk **Language** Machine code **Outlets** Apple dealers **Price** £29.95

'Only the strong survive' — it announces from the cover of Evolution. How true! You need the wrists of a gorilla, the constitution of an ox and the patience of Job to even consider playing Sydney Development Corporation's version of Evolution.

Objective

Starting as a lowly amoeba basking in protozoic slime, you have five theoretical lives to advance through an evolutionary cycle.

This cycle consists of six phases including amoeboid, tadpole, rodent, beaver, gorilla and human.

Negotiating the plethora of hazards and techniques in each phase passes you on to the next (assuming you have any lives left) until you manage to kill ten mutants during the human phase.

As long as you can do this (I couldn't), then you 'witness the end of the human race'. The logic behind this statement totally bewilders me — you've won so why end the race?

First impressions

I must admit I expected more to the packaging. All you get is the disk in an envelope proclaiming 'Sydney', with a fold-over sheet of cardboard giving instruction on the inside.

The instructions are brief but, thankfully, accurate and starting the game couldn't be easier.

Once up and running it's well worth the time just to let the program run through to acquaint yourself with the structure of each phase.

In play

Three levels of skill are available: beginner, intermediate, and expert — classed at levels 1, 7 and 13.

Considering that 99 levels are programmed into the game I can't contemplate the impossibility factor of the higher levels as 13 was way beyond me.

All phases use the same keys or joystick controls. If keyboard is used then 'up' and 'down' could have used a better layout than 'A' and 'Z'.

Poetic licence has been taken to extremes. Amoebae with a shield facility, tadpoles eating water flies, and gorillas in Africa throwing coconuts.

If in any phase you lose your lives then the whole thing starts again from the first phase. Deft use of the pause function ('ESC') is a necessity.

Verdict

Really, this is just a series of six loosely linked games, none of which is likely to maintain more than minimal interest. On the basis of this game, if Charles Darwin were around today he'd be preaching the Old Testament.

Nigel Cross

RATING
Lasting appeal — 1
Playability — 2
Use of machine — 3
Overall — 2

PCN ProgramCards

This week there is a slight change in this section because some of our previously published programs are causing a bit of confusion for some of you. We will try to clear things up.

SPIDER, VIC-20, April 1

This program has been responsible for the greatest confusion and we have received many telephone calls asking for clarification. Neil Mullings, of Halesowen, Alex Posner, of Cockfosters, and S Paterson of Washbrook, Ipswich, also wrote in asking for an explanation of some of the symbols used in the program.

Lines 20, 730, 810, 815, 875, 915 and 1010 contain statements using square brackets: [and]. These statements mean that when the program is typed into the machine the characters inside the brackets (including the brackets) must be replaced by the special characters that the Vic-20 uses to perform that function.

For instance, in line 730 [HOME] [6CR] [8CD] should be changed to one cursor home character, six cursor right characters, and eight cursor downs.

There was another problem in line 100 which contained a character not on the Vic keyboard. This symbol, ^, should be replaced by the up arrow (next to the RESTORE key), meaning 'raise to the power'.

With these changes the program will run without error.

SHAPE TABLE UTILITY, APPLE II, March 18

A vital piece of information was omitted from the introduction to this program and has caused Dave Bland, of Biggleswade, a few problems.

The missing note is that the program requires a dummy shape table to be resident on disk.

The quickest way to do this is to enter the Monitor program (type in CALL-155). When * appears on the screen type in 5000:46 00 8E 00.

As soon as the RETURN key is pressed the values are stored in memory. At this point return to Applesoft or Integer and save the dummy table on disk with BSAVE Filename, A$5000, L$4400, D2.

Once this is done the program can be used without any of the frustrating error messages appearing.

ANALOGUE CLOCK, BBC MODEL B, March 25

Roderick Buchanan of Stockport was not very happy with this program and has suggested a few modifications.

First, add the line:–

55 VDU 29, 512; 512

which sets the origin to 512, 512. Then all X+ and Y+ can be removed from succeeding PLOT 85, MOVE and DRAW statements.

For example, line 230 becomes:–

230 PLOT85, R2*SIN(TH), R2COS (TH)

Also, MOVEX,Y becomes MOVE0,0.

Secondly, if any key other than "A" or "O" is pressed the clock gains time. To safeguard against this, the time-lapse section of the program should be rewritten using a WAIT until TIME MOD 100 = 0 construct.

TUNESMITH, ORIC-1, April 8

Another omission occurred in this program and was ably spotted by Steve Mellin from Wolverhampton. Line 5090 should read:–

5090 IF N(C) = 16 THEN MUSIC 1,1,1,0: GOTO 5160

This means that the breath function will act correctly instead of repeating the last note played.

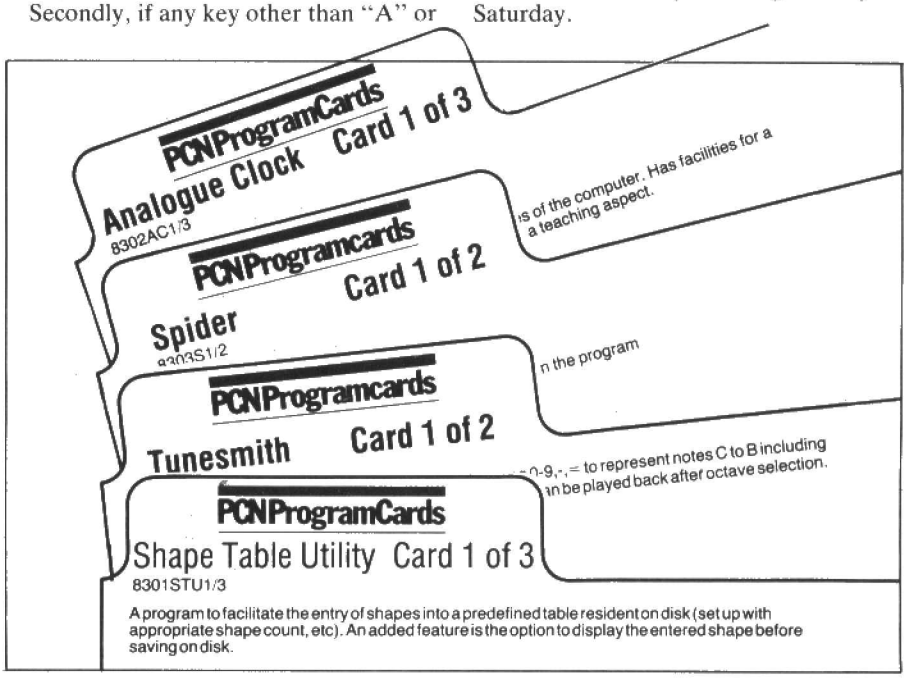
This Week

We start with four more ProgramCards for Wacky Racers, by MM Tew of Coventry. The final pair will appear next week.

Mr G T Childs of Winchcombe, Gloucs, has produced a very useful program for those of you with mortgages. His Sharp MZ80K program takes simple information and produces a list of the monthly repayments per year for both old (tax relief) and new mortgage schemes.

The ubiquitous Miklos Shawl of Paddington Green, London (remember his Pascal program in our first issue?), has now invested in a BBC Model B and has sent in another program. This utility is very useful as it allows function key set-up and date and time initialisation.

Our subroutine this week is a solution to the perennial problem of calculating the day of the week for a given date. It returns a value of 0 to 6 representing Sunday to Saturday.



This method means that it is left to you to define your own preference for day names, perhaps French or German? In our example program the calculated day of the week is used as an index to the children's rhyme in the program.

See your name in print!

Become a legend in your own lunchtime. Send your example of programming expertise on disk or cassette with a plain paper printout to the address below.

We'd also like a brief description of what the program does, and notes including memory requirements, special hardware needed etc.

All programs are checked by a referee before publication so that only fully debugged programs are published.

As if the promise of fame was not enough we'll even pay you for them, at our standard rates.

Should you require your material to be returned please enclose an SAE.

If you are interested in becoming a referee for submitted programs then send details of experience, machines covered etc to: Programs Editor, Personal Computer News, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

PCNProgramCards

Wacky Racers Card 4 of 9

8306WR4/9

```
1550 DATA"****************************************"
1552 DATA"****************************************"
1554 DATA"*****                          *********"
1556 DATA"***                i             ********"
1558 DATA"**          ****          ******        **"
1560 DATA"***   **    *****         ******        **"
1562 DATA"***  ***    *****   *****  ******    * **"
1564 DATA"****       *******          ******   * **"
1566 DATA"******     ********          ******  * **"
1568 DATA"***** .   ************         ****  * **"
1570 DATA"****     ***************   *     *** * **"
1572 DATA"***      ***************   **    ***i* **"
1574 DATA"*** i   **************     ****   ***   **"
1576 DATA"**      *************   ******   ***   **"
1578 DATA"**      *************   ******   ***   **"
1580 DATA"*        ***********   *******   *** * **"
1582 DATA"*       ***********   ********   ***i* **"
1584 DATA"*     **************  *******     ** * **"
1586 DATA"*     **************  *******          **"
1588 DATA"**      ****           ******         **"
1590 DATA"**       ***              **          ***"
1592 DATA"**   i                    *          ****"
1594 DATA"***                          i     *****"
1596 DATA"*******             ********      ******"
1598 DATA"****************************************"
1599 DATA£,15,23,6,@
1600 DATA"****************************************"
1602 DATA"****       *****************          ****"
1604 DATA"****              i                   ****"
1606 DATA"****        *********   *******      *****"
1608 DATA"*****       ********   *********     *****"
1610 DATA"*****  i    *******    ********     ******"
1612 DATA"*****       *******    ********     ******"
1614 DATA"***** ** * *******    ******** *i*******"
1616 DATA"***** ** * ******      *******    ******"
1618 DATA"***** *  * ******      *******    ******"
1620 DATA"*****       ******      *******    ******"
1622 DATA"*****           i   *  ********   ******"
1624 DATA"*****       ******     *********  ******"
1626 DATA"****       ********   **********  ******"
```

1550–1626 Circuit data statements (cont)

PCNProgramCards

Wacky Racers Card 5 of 9

8306WR5/9

```
1628 DATA"****                    ********* * ******"
1630 DATA"***       *********      ******  ***  ****"
1632 DATA"**    **  ************  ****     ***  ****"
1634 DATA"*     **  ************i ****     **   ****"
1636 DATA"**    **  **            ****     **   ****"
1638 DATA"***                                    ****"
1640 DATA"****   i                ******      i  ****"
1642 DATA"*****                                 ******"
1644 DATA"****************************************"
1646 DATA"****************************************"
1648 DATA"****************************************"
1649 DATA£,20,23,7,@
1650 DATA"****************************************"
1652 DATA"*******                      ******  i ****"
1654 DATA"*****   *                      ***       ***"
1656 DATA"***    ***  **i * i******          *     **"
1658 DATA"***  ***    **  *  *****      ********   *"
1660 DATA"**  ****    ***     ****        ******** **"
1662 DATA"*  *****    ****    *** i ***       **** **"
1664 DATA"*  *****     ***    **    *****        ** **"
1666 DATA"*  *****      **    *   *****     **    * **"
1668 DATA"*i******      **                   ***   * **"
1670 DATA"* ******i   *i***                   **   *  *"
1672 DATA"* ******    * ***   *******  ***   ** i*   *"
1674 DATA"* ******      ***    ******* i*     *  *   *"
1676 DATA"*  *****      ***     *******  *    *   * i*"
1678 DATA"*  ****       ****      *******      *  *   *"
1680 DATA"*  ****     ****     *  *******     ** ** *"
1682 DATA"*  ****   *****    ****i    *****    **   * *"
1684 DATA"*   ***   *****i *******   ***** i  **   * *"
1686 DATA"**  ***   ****  ********    ****    **   * *"
1688 DATA"**   **         ********    ****    **   * *"
1690 DATA"***  **                     ***     **   * *"
1692 DATA"***                          *      **   * *"
1694 DATA"*****************                    **     *"
1696 DATA"*****************          i         **     *"
1698 DATA"****************************************"
1699 DATA£,18,22,14,@
1700 DATA"****************************************"
1702 DATA"****         i       ****              *"
```

1628–1702 Circuit data statements (cont)

PCNProgramCards

Wacky Racers Card 6 of 9

8306WR6/9

```
1704 DATA"***      *     **       ***     *****     i *"
1706 DATA"** i ****    *** **    i**   *******       *"
1708 DATA"*    *****   **** **      **   **************"
1710 DATA"*   ******   ****              **************"
1712 DATA"*   ******   **    **                      *"
1714 DATA"*   ******   **   ***      i     *   ******  *"
1716 DATA"*   ******   *   ****   **   **   **   **** i *"
1718 DATA"*   ******             **i***   ***   ***   **"
1720 DATA"*   ******              *        **** i*   ***"
1722 DATA"*      i      *****        *    ***         **"
1724 DATA"*    *************    ***i**   ***          *"
1726 DATA"* i *********  i       **   ** i***    *     *"
1728 DATA"*        **    *      *       ***        ***   *"
1730 DATA"*                 **   *      ****       *****  *"
1732 DATA"************    **    *   *****     ******   *"
1734 DATA"************    *** i  *             ******   *"
1736 DATA"*********       ****                  ****   *"
1738 DATA"**          *********      ***          ***   *"
1740 DATA"**    *******               ***   ****    **   *"
1742 DATA"**     ***             **       ******    *   *"
1744 DATA"****    i             **** i ********       *"
1746 DATA"************         ***************** i    *"
1748 DATA"****************************************"
1749 DATA£,17,22,17,@
1750 DATA"****************************************"
1752 DATA"*****                                 *****"
1754 DATA"***      i                        i      ***"
1756 DATA"**                                       **"
1758 DATA"**       *****       **   **       *****      **"
1760 DATA"*      *******     ***   ***     *******      *"
1762 DATA"*     ********     ***i  ***.    ********     *"
1764 DATA"*    *********     **    **      *********    *"
1766 DATA"*    *********                   *********    *"
1768 DATA"*    *********                   *********    *"
1770 DATA"*     ********        **         ********     *"
1772 DATA"*           **       ****        **           *"
1774 DATA"* i          i   ***i******i**   i          i  *"
1776 DATA"*           **       ****        **           *"
1778 DATA"*     ********        **         ********     *"
1780 DATA"*    *********                   *********    *"
```

1704–1780	Circuit data statements (cont)

PCNProgramCards

Wacky Racers Card 7 of 9

8306WR7/9

```
1782 DATA"*    *********                   *********    *"
1784 DATA"*    *********      **   **      *********    *"
1786 DATA"*     ********     *** i***     ********      *"
1788 DATA"*      *******     ***   ***     *******      *"
1790 DATA"**      *****       **   **       *****      **"
1792 DATA"**                                           **"
1794 DATA"***      i                           i      ***"
1796 DATA"*****                                       *****"
1798 DATA"****************************************"
1799 DATA£,29,23,12,@
1800 REM
1801 REM
1802 REM
1803 REM
1804 REM
1805 REM*TO ADD EXTRA SCREENS START DATA WITH A '@'*
1806 REM*THEN TYPE IN 25 LINES OF DATA AS ABOVE IN LINES*
1807 REM*1750 TO 1798.DO THIS IN SPARE LINES*
1808 REM*1415 TO 1999*
1809 REM*END THIS DATA WITH 'DATA£,X,Y,N'.*
1810 REM*WHERE 'X' IS THE X COORDINATE OF THE CAR'S*
1811 REM*START POSITION & 'Y' IS THE Y COORDINATE*
1812 REM*OF THE CAR'S START POSITION.'N' IS*
1813 REM*THE NUMBER OF 'i' ON THE TRACK.*
1814 REM*FINALLY UPDATE THE NUMBER OF TRACKS IN LINE 1.*
1815 REM
1816 REM
1817 REM
1999 REM*INITIALISE VARIABLES.*
2000 GOSUB1000

2010 DIM C(8),D(8)
2020 FORI=1TO8:READD(I),C$:C(I)=ASC(C$):NEXT
2030 HS=0
2050 DIMSD(10)
2060 FORI=1TOMS:READSD(I):NEXT
2190 RETURN
```

1782–1799	Final circuit data statements
1800–1817	Description of how to set up user defined circuits
2000	Load initial data statements at 1100–1180
2010–2020	Load car direction data statements at 1400–1470
2030–2060	Load data statements at 1475
2190	Return to mainline

PCN ProgramCards

Mortgage Comparison

8306MC1/2

Card 1 of 2

A program to take mortgage and years of payment as input producing a list of monthly payments due. This list compares the new mortgage repayments scheme with the old system of tax relief on mortgages. It is interesting to note that the new system is usually beneficial in the long run.

```
 10 U = 30: V = 10
 20 DEF FNA(X) = INT(X*100 + 0.5)/100
 30 PRINT "[CH][3CD]"
 40 PRINT "DO YOU WANT TO CHANGE TAX (30%) OR
 50 PRINT "MORTGAGE RATE (10%)? Y/N."
 60 GET Z$: IF Z$ = "" THEN 60
 70 IF Z$ = "N" THEN 100
 80 INPUT "[2CD]ENTER TAX RATE.    "; U
 90 INPUT "[2CD]ENTER MORTGAGE RATE.    "; V
100 PRINT "[2CD]ENTER TOTAL MORTGAGE.
110 INPUT "£ "; T
120 PRINT "[2CD]OVER HOW MANY YEARS?"
130 INPUT Y
140 GOSUB 390
150 C = A: S = T
160 W = U: U = 0
170 GOSUB 390
```

Sharp MZ80K
Sharp Basic

General interest

Author: G T Childs

To avoid possible errors during the printing process of this program all cursor control characters have been replaced with a string embedded within "[","]" at the appropriate point. Do **NOT** type in the string or brackets but replace with the indicated special charcater in the accompanying text.

10	Set tax (*U*) and mortgage rate (*V*) to 30% and 10%
20	Function to express a number to two decimal places
30	CH = clear screen and cursor home character. 3CD = 3 cursor down
40–50	Prompt for tax and rate changes
60-70	Single key response. Blank entry not allowed. "N" — skips past change routine
80	2CD = 2 cursor down characters.
110	Input total mortgage value. Note mortgage relief only acts up to £30,000
120	2CD = 2 cursor down characters.
130	Input number of years of repayment period
140	Calculate of monthly net payments
150	*C* — new system monthly payment, *S* — running total owed
160	*W* — standard rate of tax, *U* — set to 0% tax rate for old system calculations
170	Perform calculation

PCN ProgramCards

Mortgage Comparison

8306MC2/2

Card 2 of 2

```
180 PRINT "[CH]";
190 PRINT "YR. "; "NET PER MONTH", "STILL OWING
200 PRINT "    NEW", "OLD", "NEW", "OLD"
210 FOR N = 1 TO Y
220   PRINT STR$(N); FNA(C), FNA(A - T*W*V/120000),
230   T = T - 12*A + T*V/100
240   S = S - 12*C + S*V*(100 - W)/10000
250   J = J + 12*(A - T*W*V/120000)
260   PRINT FNA(S), FNA(T)
270   IF INT(N/21) <> N/21 THEN 300
280   PRINT "PRESS ANY KEY TO CONTINUE."
290   GET Z$: IF Z$ = "" THEN 290
300   NEXT
310 PRINT "TOTAL PAID :", FNA(C*Y*12),
320 PRINT                 FNA(J)
330 PRINT "ANOTHER ONE? Y/N";
340 GET Z$: IF Z$ = "N" THEN END
350 IF Z$ = "Y" THEN RUN
360 GOTO 340
370 REM Subroutine to calculate monthly
380 REM net payments.
390 K = 1 + (100 - U)*V/10000
400 IF (K > 2) + (K < 1) + (Y > 40) THEN GOTO 460
410 B = K↑Y
420 A = B*(K - 1)*T/(B - 1)/12
430 RETURN
440 REM Avoid absurd entry and crash in
450 REM line 410.
460 PRINT "Is your building society on Mars?
470 PRINT "TRY AGAIN!": FOR N = 1 TO 2000: NEXT: RUN
```

180	CH = clear screen and cursor home character
190-200	Page headings
210	Year calculation and print loop
220	Print year number, new systems net, old system net
230	*T* — running total under old system (owing)
240	*S* — running total under new system (owing)
250	*J* — cumulative total paid old system (net)
260	Print new system owed, old system owed
270	Page overflow check
280–290	If page end then allow operator response to go onto next page
310	Print end heading and new system total paid
320	Print old system total paid (net)
340	Single key response.
350	If "Y" then program re-runs itself
360	Do follow the instructions!
390	First part of calculation routine
400	Trap for posssible overflow error in line 410
410	Second part of calculation
420	Third part of calculation
460-470	Oh dear!

PCNProgramCards

Computer Set Up Card 1 of 6

8306CSU1/6

This useful program allows the initialisation of date, time, function keys, and break key for use by other programs.

BBC Model A/B
BBC Basic

Utility

Author: M Shawl

```
 1
 2 REMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREM
 3 REM
 4 REM
 5 REM                    ** SETUP **
 6 REM
 7 REM
 8 REM
 9 REM  To inititialise the pseudo-variable  TIME,  the BREAK
10 REM  key  and the ten function keys for the BBC computer.
11 REM
12 REMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREMREM
13
14  MODE 6
15  dX% = 28
16  dY% = 8
17  tX% = 12
18  tY% = 10
19
20  PROC_FunctionKeys
21  PROC_UpDate  :REM**( Initialising date$ & D% )
22  MODE 7
23  VDU 23;8202;0;0;0;
24  PRINT TAB( dX%, dY% ); date$
25  flashing% = TRUE
26  PROC_CheckTIME ( flashing%, tX%, tY% )
27  CLS
28  PRINT TAB( dX%, dY% ); CHR$( 136 );date$
29
30    REPEAT
31        PROC_printTIME ( NOT flashing%, tX%, tY%, TIME )
32    UNTIL FALSE
33
34  END
35
```

14 Two colour text. No graphics
15–16 Date display TAB positions
17–18 Time display TAB positions
20 Call function key set up procedure
21 Call date set up procedure
22 Teletext display
23 Turn off text cursor
24 Display current date
25 Flag for time display flash
26 Call for time set up procedure
27 Clear screen
28 Display current date
30–32 Loop forever displaying current time
34 Program end — theoretical

PCNProgramCards

Computer Set Up Card 2 of 6

8306CSU2/6

```
36      REM************************
38 DEF PROC_FunctionKeys


40  *key 0 LISTO0|m|nLIST|m
41  *key 1 RENUMBER 1000,100|m

42  *key 2 LOAD "" |m
43  *key 3 P.'''CHR$(136);TIME DIV 360000;":";TIME DIV 6000 MOD 60'''|m
44  *key 4 CLS:PRINT TAB(32,3);D%|m

45  *key 5 LISTO 7|m|o LIST |b|m|c

46  *key 6 MODE 6|m VDU 23;8202;0;0;0;|m

47  *key 7 LISTO 7|m CLS|m|n LIST|m

48  *key 8 MODE 3|mVDU 23;8202;0;0;0;|m

49  *key 9 CLS|m RUN |m

50  *key10 OLD |m

52 ENDPROC :REM***( FunctionKeys )
54      REM************************
56 DEF PROC_alterD ( D$ )


57                  REM *** updating `D%`
59      LOCAL digit%, value%, zero%
61  digit% = ASC( D$ )

62  zero%  = ASC( "0" )
63  value% = digit% - zero%
65  IF ( value% <= 9 ) AND ( value% >= 0 ) THEN D% = 10*D% + value%

67 ENDPROC :REM***( alterD )
```

38 Function key set up procedure. These are examples and can be changed to other requirements
40 Key 0: LIST program in memory
41 Key 1: Renumber program in memory
42 Key 2: LOAD program to memory
43 Key 3: Print current time (HH, MM)
44 Key 4: Print current date (unformatted)
45 Key 5: LIST program in memory with indents
46 Key 6: Set two-colour text. Turn off cursor
47 Key 7: As key 5 but clears screen first
48 Key 8: Set two-colour text. Turn off cursor (NB Model B only)
49 Key 9: Clear screen. RUN program in memory
50 BREAK: Keep old program in memory
52 Return to mainline
56 Procedure to add a digit from date input string to date as store in *D%* which is available to other programs as *D%* (Format DDMMYY)
59 Locally used variables
61 ASCII value of digit passed from date string
62 ASCII value of zero
63 Decimal representation of digit.
65 *D%* only updated if digit is in range 0-9
67 Return to mainline

PCNProgramCards

Day of Week Card 1 of 1

8306SubDOW

A sub-routine to calculate the day of the week for any date from 1752 (adoption of the Gregorian calendar) to an arbitrary limit of 7999 using the Gaussian formula.

```
6300 REM CALCULATE DAY OF WEEK
6310 REM
6320 REM REQUIRES D%  - DAY OF MONTH
6330 REM
6340 REM          M%  - MONTH NUMBER (1-12)
6350 REM
6360 REM          Y%  - YEAR (FULL NUMBER)
6370 REM
6380 REM USES     C%  - CENTURY NUMBER
6390 REM
6400 REM          A%  - INTERMEDIATE ARGUMENT
6410 REM
6420 REM RETURNS  DN% - NUMBER OF DAY IN WEEK
6430 REM
6440 REM          0-6 = SUNDAY,MONDAY....SATURDAY
6450 REM
6460 REM           -1 = INVALID
6470 REM
6480 DN% = -1
6490 IF Y% < 1752 OR Y% > 7999 THEN RETURN

6500 M% = M% - 2: IF M% < 1 THEN M% = M% + 12: Y% = Y% - 1

6510 C% = INT(Y%/100): Y% = Y% - C%*100

6520 A% = INT(2.6*M% - 0.19) + INT(Y%/4) + INT(C%/4) + D% + Y% - C%*2

6530 DN% = INT((A%/7 - INT(A%/7))*7 + 0.1)
6540 RETURN
```

Although written in Microsoft Basic this can be modified to run on all machines

6320	*D*% should be verified prior to entry (1-31, 30, 29, 28)
6340	*M*% should be verified prior to entry (1-12)
6360	*Y*% is full four digit year number
6420	*DN*% is a value (−1 to 6) returned to the program. −1 is error, 0 = Sunday, 1 = Monday etc
6480	Set to error value
6490	Check year range. If out of range return to mainline
6500	Shift month round to compensate for leap years
6510	Calculate century number and year number in century
6520	Intermediate stage in calculation
6530	Final result
6540	Return to mainline

PCNProgramCards

Birthday Rhyme Card 1 of 1

8306BR

A simple program to demonstrate the use of the Day of Week sub-routine by taking a date and returning the appropriate extract from the children's rhyme

```
6000 REM BIRTHDAY RHYME PROGRAM
6010 REM Demonstrates the use of CALCULATE DAY OF WEEK Sub-routine
6015  MODE 0
6020 CLS: PRINT: PRINT "By inputting your date of birth the program will displa
y the appropriate line(s) from the rhyme :="
6030 RESTORE: PRINT

6040 FOR N = 1 TO 8: READ R$: PRINT R$: NEXT N
6050 INPUT "INPUT DAY (1-31)",D%
6060 IF D% < 1 OR D% > 31 THEN PRINT "PROGRAM ENDED": END
6070 INPUT "INPUT MONTH (1-12)",M%
6080 IF M% < 1 OR M% > 12 THEN GOTO 6070
6090 INPUT "INPUT YEAR (FORMAT YYYY)",Y%
6100 IF Y% < 1 OR Y% > 9999 THEN GOTO 6090
6110 REM
6120 GOSUB 6480
6130 IF DN% < 0 THEN PRINT "YEAR OUT OF RANGE - RETRY": GOTO 6090
6140 IF DN% = 0 THEN DN% = 7

6150 RESTORE
6160 FOR N = 1 TO DN%
6170   READ R$
6180   NEXT N
6190 PRINT R$
6200 IF DN% = 7 THEN READ R$: PRINT R$
6210 GOTO 6050
6220 DATA "MONDAY'S CHILD IS FAIR OF FACE"
6230 DATA "TUESDAY'S CHILD IS FULL OF GRACE"
6240 DATA "WEDNESDAY'S CHILD IS FULL OF WOE"
6250 DATA "THURSDAY'S CHILD HAS FAR TO GO"
6260 DATA "FRIDAY'S CHILD IS LOVING AND GIVING"
6270 DATA "SATURDAY'S CHILD HAS TO WORK FOR ITS LIVING"
6280 DATA "THE CHILD THAT IS BORN ON THE SEVENTH DAY"
6290 DATA "IS BONNIE AND BLITHE AND GOOD AND GAY"
```

BBC Model B
BBC Basic

General interest

6015	Set screen mode
6020	Clear screen. Print instructions
6030	Set read pointer to 1. Space one line
6040	Display whole rhyme
6050–6060	If day input is out of range program ends
6070-6080	Verify month input
6090–6100	Verify year input
6120	Perform sub-routine
6130	Error — re-enter year
6140	If Sunday then set *DN*% to line 7 of rhyme
6150	Set read pointer to 1
6160–6180	Loop to read correct line in rhyme
6190	Display line from rhyme
6200	Second line for Sunday
6210	Round again
6220–6290	Data statements for rhyme

CLUBS

Clubnet keeps you in touch with the microcosm of personal computer enthusiasts throughout the UK. It is divided into two sections — clubs and user groups.

We will publish a list of each section on altenate weeks, and this week is the turn of clubs.

Entries include up-to-date information as far as possible, and group organisers should let us know of change.

And if you've just started your own club drop us a line and we'll spread the word. Write to: Clubnet, *Personal Computer News*, VNU, 62 Oxford Street, London W1A 2HG.

AVON

Worle Computer Club. Meets at Woodsprings Inn Function Rooms on alternate Mondays at 7-10.30pm (annual subs: £12).

Contact S W Rabone, 18 Castle Road, Worle, Weston-super-Mare, Avon, tel: 0934-513068

BEDFORDSHIRE

Bedford Amateur Computer Club. Meets at Star Rowing Club, Bedford, on the first and third Tuesday of each month at 8pm (annual subs: £3). Contact Rowan Bird, 74 High Street, Great Barford, Beds MK44 3LB, tel: 0234-870763.

Chiltern Computer Club. Meets at Five Bells, Eaton Bray, Near Dunstable, Leighton Buzzard on second and fourth Monday of each month (annual subs: £2 senior members, £1 under-14s).

Contact Steve Butts, 42 Wallace Road, Eaton Bray, Bedfordshire OU6 2DF, tel: 0525-220922.

Luton College Computer Club.

Contact John Rodger, tel: 0582 3411.

Luton Computer Club.

Contact J P Fletcher, 1 Trowbridge Gardens, Luton, Beds LU2 7JY, tel: 0582-450687.

BERKSHIRE

Easthampstead Computer Club. Meets at Easthampstead Park School, Easthampstead Park Mansions, Bracknell, on the first Wednesday in month at 8 pm.

Contact Brian Poulton, 0344-84423.

Small Processor User Group.

Contact Roger Knight at Department of Meteorology, University of Reading, Earley Gate, Whitenights, Reading, tel: 0734-875123.

BIRMINGHAM

Birmingham Amateur Computer Club. Meets at CBS Consultants, Watery Lane, Small Heath, Birmingham 10, on the first and third Wednesday of each month at 7pm (annual subs: £4.20 adults, £1.50 juniors).

Contact Dr M Bayliss, 125 Berryfield Road, Sheldon, Birmingham B26 3UU, tel: 021-743 7197.

BUCKINGHAMSHIRE

Aylesbury Computer Club. Meets at Quarrendon Youth Club every Friday at 7.30pm (annual subs: £5).

Members also meet at Mandsville County Secondary School the first Thursday of each month at 7pm.

Contact Ken Knight, 22 Mount Street, Aylesbury, tel: 0296-5181.

Chiltern Microcomputer Club. Meets at the Garden Centre, School Lane, Chalfont St Giles, on the first Wednesday of each month (annual subs: £4 for six months).

Contact Mrs W Tibbitts at Ellwood, Deanway, Chalfont St Giles, Buckinghamshire, tel: 024-07 4906.

Iver Computer Club.

Contact P A Seal at 1 Ormonde Flats, Church Road, Iver Heath, tel: 0753-652792.

CAMBRIDGE

Cambridge Microcomputer Club, meets on the third Wednesday of each month.

Contact Derek Tripp at 3 Spurgeons Avenue, Waterbeach, tel: 0223-861804.

Haverhill Microcomputer Club, meets at St Marys' Church Hall, Camps Road, Haverhill, on the second, third and fourth Wednesday of each month at 7.30 to 10.30pm (annual subs: £3 adult: £1 OAP and students: meetings 25p).

Contact Andrew Holliman, at 5 Trinity Close, Balsham, Cambridge CB1 6DW, tel: 022 029-583.

CHESHIRE

Altrincham Computer Club. Meets at N. Cestrian Grammar School, Durham Road, Altrincham, fortnightly.

Contact Martin Hickling at 39 Barrington Road, Altrincham, Cheshire WA14 1H2, tel: 061-941 4547.

Brunel Computer Club. Meets at St Werburgh Community Centre on alternate Wednesdays at 7 to 10pm.

Contact Mr R Simpson at 4 The Coots, Stockwood, Cheshire.

Cheshire Computer Club.

Contact W Collins at 37 Garden Lane, Chester, Cheshire.

Crewe Computer Users Club meets at Buffaloes Club, Earl Street, Crewe, Cheshire, on the third Thursday of each month at 8pm.

Contact Bram Knight on 0270-623375.

Holmes Chapel Micro Club meets at Leisure Centre, Holmes Chapel at 7.30 to 9.30pm on the first and third Tuesday of each month (annual subs: £5 adults: £2.50 children,OAP and students. Or weekly subs: 30p adults, 20p children).

Contact Margaret Baker, at 1 Helton Close, Crewe, Cheshire, tel: 0477-34238.

New Mills & District PCC meets at New Mills School, fortnightly on Fridays at 7 to 9.30pm, meetings 35p.

Contact Mr G M Flanagan, at 11 Sundown Close, New Mills, Stockport, Cheshire SK12 3DH, tel: 0663-44051.

Northwest Computer Club meets fortnightly, meetings 25p.

Contact John Lightfoot at 13 Aston Drive, Frodsham, Warrington, Cheshire WA6 7PU, tel: 0728 31519.

Northwest Computer Club, weekly meetings. Annual subs: £1; meetings 30p (visitors 50p).

Contact Tom Wyatt at 29 Summer Lane, Halton, Runcorn Cheshire WA7 5PG, tel: Runcorn 77545.

CLEVELAND

Cleveland Micro Club meets on the second and third Tuesday of each month, under 18s on second of the month, over 21s on third Tuesday of the month.

Contact J Telford at 13 Weston Crescent, Norton.

Stockton Amateur Computer Club meets at Stockton YMCA every Monday at 7pm, meetings 20p to be reviewed.

Contact P J Cheshire at 60 Croft Road, Eaglescliffe, Stockton-on-Tees, Cleveland. TS16 0DY.

CORNWALL

Cornish Radio Amateur Club — Computing Section.

Contact Bob Reason at 24 Mitchell Road, Camborne, Cornwall.

Cornwall Area Computer Club.

Contact M F Grove at 35 Causeway Heard, Penzance.

St Austell Computer Club and Computer Town meets at ECIP Labs, Penpewan Road, St Austell, fortnightly on Mondays at 7.30pm.

Contact N G Day at 2 Cilendale Close, St Austell, Cornwall PL25 3DD.

DERBY

Glossop Computer Club.

Contact John Dearn, 2 Spinney Close, Glossop, Derbyshire.

Derby Micro Society meets at Littleover Church Hall, Sheperd Street, on every other Thursday at 7pm. Annual subs: £5, £2.50 children, £7.50 for families, 50p entrance non-members.

Contact Mike Riordan, tel: 0332-769440.

DEVON

Exeter & District Computer Club meets at Exeter School, Magdalene Road, Exeter, on the second and fourth Tuesday every month.

Annual subs: £7.50 adults, £2.00 for students. Technical library.

Contact Ian Hodgeson, 21 Dean Street, Exeter, tel: 0392-50812.

Exeter & District Amateur Computer Club meets second Tuesday every month. Annual subs: £7.50.

Contact Doug Bates, Fortescue House, Stoke Cannon, Exeter. Specialist meetings on third and fourth Tuesday.

Torbay Users Computer Club meets at Devon Computer Services, 96 Dartmouth Road, Paignton on Mondays fortnightly. Annual subs: £2.00 juniors, £5.00 adults, meetings 20p, children welcome. Technical library available.

Contact J D Parker, tel: 0803-843964.

DORSET

Bournemouth Area Computer Club meets at Kinson Community Centre on the third Wednesday every month. Annual Subs: £5 adults; £2.50 juniors.

Contact Peter Hibbs, 54 Runnymede Avenue, Bournemouth, Dorset BH11 9SE, tel: 0202 576547.

TOPIC meets at Canteen English Truck Centre on the second and fourth Wednesday every month at 7pm. Annual subs: £5, reduced fees for students.

Contact David Washford, 1 Alexander Road, Bournemouth, Dorset BH6 5JA.

Purbeck Computer Club, contact 31 North Street, Wareham, Dorset BH20 1AD.

DURHAM

Darlington Computer Club, weekly meetings and informal discussion. Technical library available.

Contact L Boxell, 8 Vane Terrace, Darlington DL3 7AT, tel: 0325-67766.

ESSEX

Brentwood Amateur Computer club, proposed new club.

Contact R Sadler, 18 Wanescot Road, Brentwood, Essex CM15 9HD.

Springfield Computer Club meets on the first Friday of every month.

Contact Stephen Cousines, 1 Aldeburgh Way, Springfield, Chelmsford, Essex CM1 5PB, tel: 0245 50155.

Colchester Microprocessor Group meets at University of Essex on the second and fourth Wednesday of every month at 7.30pm. Annual subs: £5.

Contact Information Centre, University of Essex, near Colchester.

Romford Club, a new club.

Contact Mr D Norden, 138c Church Road, Romford Essex.

South East Essex Computer Society meets at Hockey Club at Roots Hall, near Southend Football Stadium on Wednesdays at 7.30pm. Open to members over 14.

Contact Robin Knight, 128 Little Wakering Road, Little Wakering, Southend-on-Sea, Essex, tel: 0702-218456.

Stanway School Computing Club, only school members at present.

Contact G Floyd, c/o Physics Department, Stanway School, Stanway, Colchester, Essex.

GLOUCESTERSHIRE

Cheltenham Amateur Computer Club meets on the third Tuesday of each month at 7.30pm.

Contact Mike Pullin on 0242-25617 or Robin Phelps on 0242-584343.

British Amateur Electronics Club. Independent club with newsletter, beginner's section, library, annual exhibition catering for all ages.

Contact Mr J Margetts, 3 Bishopstone Close, Golden Valley, Cheltenham.

GCHQ. Contact D W Adam, 16 Court Road, Prestbury, Cheltenham.

Cheltenham Amateur Computer club meets at Prestbury Scout Headquarters, on the third Tuesday of every month at 7.30pm. Annual subs: £3.

Contact M Hughes, 36 Riverviews Way, Cheltenham, Gloucs.

HANTS

Fareham and Portsmouth Amateur Computer Club.

Contact Alan Smith, c/o Francis Close, Lee-on-the-Solent, Gosport, Hants PO13 8HB, tel: 0705-550907.

RAF Odiham Computer Club. Contact c/o Officer i/c, Royal Air Force, Odiham, Nr Basingstoke, Hants.

Southampton Amateur Computer Club meets at Medical Science Building, Bassett Crescent, East Southampton, on the second Wednesday of every month at 7.30pm. Annual subs £5, £3.50 students & OAPs.

Contact P Maddison, 'Gardenways', Chilworth Towers, Chilworth, Southampton SO1 7JH.

HEREFORD

Hereford Amateur Computer Club, proposed new club.

Contact Stuart Edinborough, 2 Warwick Walk, Bobblestock, Hereford HR4 9TG, tel: 0432-269700

HERTFORDSHIRE

Harrow Computer Club meets at Harrow College of Higher Education, Room W24 on alternate Wednesdays at 7pm. When college is closed meetings are held in the Plough, Kenton.

Contact Bazyle Butcher, 16 St Peter's Close, Bushey Heath WD2 3LG, tel: 01-950 7068.

Harpenden Microcomputer Club meets at Silver Cap, Harpenden on alternate Mondays. Annual subs £2.50.

Contact David James, 5 Ox Lane, Harpenden, Hertfordshire AL5 4HH.

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HUMBERSIDE

Forum 80 Users Group. Contact Frederick Brown, 421 Endike Lane, Hull HU6 8AG.

Grimsby Computer Club meets at Grimsby Central Library fortnightly on Mondays at 7.30pm.

Contact Jenson Lee, 29 Park View, Cleethorpes, tel: 0472-42559.

Scunthorpe & District Microprocessor Society meets at Community Centre, Lindun Street, Scunthorpe, every Tuesday at 7.30pm. Annual subs £2, families £5.

Contact G Hinch, 21 Old Crosby, Scunthorpe, South Humberside DN15 8PU.

KENT

Canterbury ACC proposed new club.

Contact L Fisher, 21 Manwood Avenue, St Stephens, Canterbury, Kent CT2 7AH.

Medway Amateur Computer & Robotics Organisation meets on the first Tuesday and third Wednesday of every month. Annual subs £5.

Contact Paul Cameron, Small Community Centre, Lordwood Lane, Lordwood, Chatham, Kent, tel: 0634-63036.

Amateur Computer Club, annual subs: £4.50 (£2 for under 18s, OAPs).

Contact Rupert Steele, St John's College, Oxford OX1 3JP.

North Kent Amateur Computer Club meets at Lecture Theatre, Charles Darwin School, Jail Lane, Biggin Hill, Kent, on the first Thursday of every month at 7.30pm. Annual subs £3, £1 students.

Contact Iain House, 228 Canadian Avenue, Catford SE6 3AS, tel: 01-690 5441.

Orpington Computer Club meets at The Large Hall, Christ Church, Chaterhouse Road, Orpington, Kent, every Friday at 8pm-10.30pm. Insurance cover for all members' equipment while on club premises.

Contact Mr R Pyatt, 23 Arundel Drive, Orpington, Kent BR6 9JF, tel: Orpington 20281.

National Personal Computer User Association, annual subs £12.

Contact Eric Keeley, 11 Spratling Street, Manston, Ramsgate, Kent.

Sevenoaks School Computer Club.

Contact G Sommerhoff, Technical Centre, Sevenoaks School, Sevenoaks, Kent, tel: 0732-456490.

Tonbridge & Tunbridge Wells ACC.

Contact Ray Szatkowski, 1 Cromer Street, Tonbridge, Kent, tel: 0732-355960.

Computer Users Club.

Contact Tony Latham on 01-304 3910.

LANCASHIRE

Blackburn Micro Computer Club.

Contact Roger Longworth, 12 Sharp Close, Accrington, Lancs.

Bolton Computer Club meets at E4/24 Bolton Institute of Higher Education, Deane Road, Bolton, on Thursdays. Annual subs: £1.

Contact David Atherton, 16 Douglas Street, Asherton, Manchester M29 9FB, tel: 0942-876210.

Burnley Computer Club meets at Carleton Hotel, Standish Street, on Tuesdays 7.30-11pm.

Contact Clive Tallon, 27 Basnett Street, Burnley, Lancs BB10 3EQ.

Ribble Valley Computer Club meets at Staff Canteen, Pendle Carpets Ltd, West Bradford, on the second and fourth Monday of every month at 7-9pm.

Contact Ian Thornton-Bryar, 25 Southfield Drive, West Bradford, Clitheroe, Lancs BB7 4TU.

Lancaster & Morecambe Computer Club.

Contact Sarah Blackler, tel: 0524-33553.

Chorley Computer Club meets at Townley Arms, Chorley, every other Tuesday at 8pm.

Contact Chris Hicks, 131 Market Street, Chorley, Lancashire.

South Chadderton Computer Club meets at Turf Lane Centre, Turf Lane, Chadderton, on Thursdays at 7-9.30pm.

Contact Mr Jakeman, 26 Mardle Street, Dorker, Oldham, Lancs, tel: 061-682 120.

LEICESTERSHIRE

East Leake Computer club.

Contact Andrew Jones, 59 Bateman Road, East Leake, Loughborough, Leicestershire LE12 6NN.

LINCOLNSHIRE

Lincoln Computer Club, meets at Blandings Public House, High Street, Lincoln on the first and third Wednesday of every month.

Contact John Clifford, 448 Newark Road, Lincoln LN6 8RX, tel: 0522 2168.

LIVERPOOL

BBC Microgroup Liverpool meets at Old Swan Technical College, Liverpool, on the first Wednesday of every month.

Contact Nick Kelly, 56 Queens Drive, Walton, Liverpool L4 6SH.

LONDON

East London Amateur Computer Club meets at Harrow Green Library, Cathall Road, E11, on the second and fourth Tuesday of every month at 7-10pm. Annual subs: £5.

Contact Fred Linger on 01-554 3288.

Harrow Computer Group meets at Harrow College of Higher Education, Room W24, Northwick Park, on alternate Wednesdays at 7pm.

Contact Bazyle Butcher on 01-950 7068.

Croydon Micro-Computer Club meets on the first and fourth Tuesday of every month.

Contact Vernon Gifford, 111 Selhurst Road, Selhurst SE25 6LH, tel: 01-653 3207.

Post Office HQ Microcomputer Club meets at room B145, River Plate House, 12-13 South Place, off Moorgate, on the second Thursday of every month.

Contact Vernon Quaintance, British Telecom Enterprises, Cheapside House, 138 Cheapside EC2U 6JH, tel: 01-726 4716.

The SOBAT Computer Club meets the first week of every month. Annual subs: £1.

Contact: T Kayari, 12 Calderon Road, London E11 4EU.

Laserbug, contact 4 Station Bridge, Woodgrange Road, Forest Gate, London E7 0NF.

Paddington Computer Club meets at Paddington College, Paddington Green, London W2 1NB.

Contact Peter Hill on 01-723 5762.

Forum-80 Wembley, contact Victor Saleh on 01-902 2546.

North London Hobby Computer Club meets at the Polytechnic of North London, Holloway, London N7 8DB, on every Monday, Tuesday, Wednesday and Thursday during term time and one evening a week during holidays. Annual subs: adults £25, family £40, jobless, pensioners, poly students £5.

Contact Robin Bradbeer 01-607 2789.

Southgate Computer Club, annual subs £2.50.

Contact Panos Koumi, 33 Chandos Avenue, London N14.

Richmond Computer Club meets at Richmond Community Centre, Sheen Road, Richmond, on the second Monday of every month at 8pm.

Contact Bob Forster, 18a The Barons, St Margarets, Twickenham, Middlesex, tel: 01-892 1873.

South East London Microcomputer Club meets at Thames Polytechnic, Greens Ends, Woolwich SE18, on alternate Wednesdays at 7pm. Annual subs: £5.

Contact Peter Phillipps, 61 Graigerne Road, SE3, tel: 01-853 5829.

Southgate Technical College Computer Club meets at Room W102 Southgate Tech, fortnightly on Thursdays at 7.30pm. Annual subs: £5.

Contact Kevin Pretorius on 01-882 2282.

ITN Computer Club meets on Fridays.

Contact A Bond, 54 Farnham Road, Guildford, Surrey GU2 5PE, tel: 0485 62035.

West London Personal Computer Club meets at Back room, Fox & Goose pub, Hanger Lane, Alperton, on the first Tuesday of every month at 7.45pm. Annual subs: £5 adults, £2.50 under 16s & pensioners.

Contact Graham Brain on 01-997 8986.

London School Computer Club.

Contact Burlington Danes School, Dane Building, DuCane Road, Hammersmith, London.

Forum-80 London, contact Leon Jay on 01-286 6207.

Imperial College Microcomputer Club meets at room 145, level 1, on Tuesdays at 7.30pm.

Contact Tim Panton, c/o I.C. Union Office, Prince Consort Road, London SW7 2BB.

Metropolitan Police Amateur Computing Club meets on the first Thursday of every month at 7pm.

Contact S Farley on 01-725 2428.

MANCHESTER

Manchester Computer Club meets at the Department of Computer Science, Manchester University, Oxford Road, Manchester, on the first and third Thursday of every month at 7.30pm.

Contact David Wade, 061-941 2486.

MERSEYSIDE

Wirral Microcomputer Users Group meets at Birkenhead Technical College every Monday.

Contact J Phillips, 14 Helton Close, Birkenhead, Merseyside L43 9HP.

Merseyside Microcomputer Group meets at Merchant Taylor's School, Crosby, on second Thursday every month.

Contact Mr F Shaw, 14 Albany Avenue, Eccleston Park, Prescot, tel: 051-426 5536.

Bolton Computer Club meets Room E4/E24 Bolton Institute of Higher Education, Deene Road, Bolton, on Thursdays. Annual subs: £1.

Contact David Atherton, 16 Douglas Street, Atherton, Manchester M29 9FB.

Southport Computer Club meets weekly.

Contact Ian Bristone, 28 Weld Road, Southport, Merseyside PR8 2DL, tel: 0704-64524.

MIDDLESEX

68 Microgroup meets at Regents Park Library, Robert Street, NW1, on the third Tuesday of every month at 7.30pm. Annual subs: £5.

Contact Jim Anderson, 41 Pebworth Road, Harrow, Middlesex.

Richmond Computer Club meets at Richmond Community Centre, Sheen Road, on the second Monday of every month at 8pm.

Contact Bob Fisher, 18a The Barons St Margarets, Twickenham, Middlesex, tel: 01-892 1873.

Sunbury Computer Club meets at St Benedicts Hall, Napier Road, Ashford, on the last Tuesday of every month at 8pm.

Contact Simon Taylor, 8 Priory Close, Sunbury-on-Thames, Middlesex.

Contact Simon Clark, 83 Watling Street, Towcester, Northants NW12 7AG.

NOTTS

Ashfield Computer Club meets at Carsic Junior School, St Mary's Road, Sutton in Ashfield on the first and third Thursday every month. Annual subs £3.

Contact Derick Daines, c/o Cuttings Avenue, Sutton in Ashfield, Notts.

Nottingham Microcomputer Club meets at Friends Meeting House, Clarendon Street, Nottingham, on the first Tuesday of every month. Annual subs: £5.50 adults, £2.50 juniors, OAPs.

Contact Mr E Harvey, 6 Roseleight Avenue, Nottingham NG3 6FH.

Eastwood Town Micro Computer Club meets at Devonshire Drive Junior School every Wednesday at 5.45pm. annual subs: £5.50 adults, £2.75 juniors, £4.50 OAPs.

Contact Ted Ryan, 15 Queens Square, Eastwood, Nottingham NQ16 3BJ.

East Midlands TRS-80 Users Group.

Contact Costello, 17 Langbank Avenue, Rise Park, Nottingham NG5 5BU.

NORFOLK

East Anglian Computer User's Group meets at Crome Community Centre, Telegraph Lane, Norwich.

Contact Gill Rijzi, 88 St Benedicts, Norwich.

Anglia Computer User Group.

Contact Jan Rejzl, 128 Templemere, Sprowton Road, Norwich, tel: 0603-29652.

South Northants Computer Group meets at Anchor House, Moat Lane, Towcester, on Wednesdays at 7.30pm.

OXFORDSHIRE

Microsoc meets at Clarendon Lab, Parks Road, Oxford, every week during term.

Contact Rupert Steele, St John's College, Oxford OX1 3JP.

Association of Computer Clubs. Annual subs: £5, £2.50 under 18s and OAPs.

Contact Rupert Steele, St John's College, Oxford OX1 3JP.

Oxford Personal Computer Club. Annual subs: £8.

Contact Len Phelps, Southport Cottage, Sutton Courtenay, Nr Abingdon, Oxon OX14 4AU.

Ridgeway Computing Club meets at Swan Hotel, East Ilsley, on the second Tuesday every month.

Contact Mike Magnay, Beavers, South Street, Blubury, Didcot, Oxon OX11 0JU.

SHROPSHIRE

Telford Computer club meets at Telford ITEC on every Monday 6-9pm. Annual subs: £3.50, £1.50 unemployed.

Contact John Murphy, 10 Birchmore, Brookside, Telford TF3 1TF, tel: 0952-595959.

Ludlow & District Microcomputer Club meets at Diocesan Education Centre, Lower Galdeford, Ludlow, on the second of every month at 7.30pm. Annual subs £7.50 family, £5 adult, £2.50 student.

Contact David Law, MEB Shop, Ludlow.

SOMERSET

Sharp MZ80 Club, contact Tim Powell, Computer Centre, Yeovil College, Yeovil, Somerset.

Yeovil Computer Club.

Contact D G Carrington, 2 Romsey Road, Yeovil, Somerset BA21 5XN.

STAFFORDSHIRE

Alsager Computer Club, meets at Alsager Comprehensive School, Stoke-on-Trent, Staffs, fortnightly on Tuesday.

Contact Rex Charlesworth on 09363-77270.

The Amateur Computer Club of North Staffs meets on the third Wednesday every month. Annual subs £3.

Contact J Roll, 16 Hill Street, Hednesford, Staffordshire WS12 5DS.

Tame Valley Computer club, contact Tim Marshall, 32 Milton Avenue, Leyfields, Tamworth, Staffordshire B79 8JG.

ICL Birmingham Branch Micro Club, c/o WBA Ecclestone, 26 Browns Lane, Tamworth, Staffs.

SUFFOLK

Suffolk Microcomputer Club meets monthly. Annual subs £5.

Contact Mr S Pratt, c/o Microtek, 15 Lower Brook Street, Ipswich, Suffolk.

SURREY

Thames Valley Amateur Computer Club meets at Griffon, Caversham, on the first Tuesday every month.

Contact Brian Quarm, 25 Roundway, Camberley, Surrey GU15 1NR, tel: Camberley 22186.

Ashtead Computer Club meets on the last Thursday of every month.

Contact P Palmer, 8 Corfe Close, Ashtead, Surrey.

Ewell Micro Club, contact Dave De Silva, 316 Kingston Road, Ewell, Surrey KT19 0SU.

Farnham Computer Club, meets at Farnham 6th Form College, Morley Road, Farnham, Surrey on the second Wednesday every month. Annual subs: £2.

Contact Adam Sharp, 14 Thorn Road, Boundstone, Farnham, Surrey.

West Surrey Computer Club meets at Paddock Room, Green Man Public House, Burpham, Guildford, the first Thursday of every month. Annual subs £5.

Contact Chris Karney on 0483-68121.

Guildford Area Microcomputer Group, contact Mr M Bawtree, Royal Grammar School, Guildford, Surrey GU1 3BB, tel: 0483 502424.

TI Home Group, annual subs: £12. Contact P Dicks, 157 Bishopsford Road, Morden, Surrey.

Sutton Library Computer Club meets at Central Library, St Nicholas Way, Sutton, Surrey, on the first Friday of every month at 6pm and second and third Tuesday of every month. Annual subs: £6, £4 OAPs, £2 family.

Contact Dave Wilkins on 01-642 3102.

CBBS London meets on Sundays 4-10pm. Contact P Goldman, PO Box 100a, Surbiton, Surrey KT5 8HY.

Thames Valley Computer Club meets in Griffin Pub, Caversham. Annual subs £1, 50p a meeting.

Contact Phil Warn, Reading 594874.

Association of London Computer Clubs, contact Len Stuart, 89 Mayfair Avenue, Worcester Park, Surrey KT4 7SJ.

Worthing & District Microcomputer Club meets at Rose Wilmot Youth Centre, Littlehampton Road, Worthing, on alternate Sundays 11am-1pm. Annual subs £4 adults, £2 students, £5 family.

Contact T Pearson, 142 King Edward Avenue, Worthing.

SUSSEX

Arun Microcomputer Club meets at Wick Amenity Centre, Wick Farm Road, Littlehampton, W Sussex, on the first Monday of every month at 8pm, and third Sunday of every month at 6pm. Fees: £3 six months, £1 joining fee.

Contact P Cherriman, 7 Talbot Road, Littlehampton, West Sussex DN17 7BL.

Micro Enthusiasts, new club proposed. Contact G Diannage, 16 Malvern Street, Hove, Sussex BN3 3YR.

Mid-Sussex Microcomputing Club.

Contact Jeff Hayden, 2 Hillary Close, East Grinstead, W Sussex RH19 3XQ.

West Sussex Microcomputer Club meets at Room RO6, Robinson Road Annexe, Crawley, on the first and third Monday every month. Annual subs: £6 adults, £3 students.

Contact J Clarke, 31 Hyde Heath Court, Pound Hill, Crawley, W Sussex, tel: 0293-884207

TYNE & WEAR

Newcastle -upon-Tyne Personal Computer Society meets at Room D103, Newcastle Polytechnic on the first Tuesday of every month. Annual subs £6.

Contact Pete Scargill, 21 Percy Park, Tynemouth, tel: 0632-573905.

WEST MIDLANDS

West Midlands Amateur Computer Club meets at Elmfield School, Love Lane, Stourbridge, on the second and fourth Tuesday every month. Annual subs £4, £3 full-time students.

Contact John Tracey, 100 Booth Close, Brierley Hill, Kingswingford, W Midlands, tel: 0384-70097.

Walsall Computer Club meets at Park Hall Community School on the second and fourth Monday every month 6.45-9.45pm. Annual subs £5 adults, £3.50 students.

Contact Alison Hunt, 58 Princes Avenue, Walsall, W Midlands, WS1 2DH, tel: 0922-23875.

Cannock Computer Society meets at Cannock Computer Systems, Old Penkridge Road, Cannock, fortnightly. Annual subs: £3 adults, £1 students.

Contact Terry Sale, 20 Redwood Drive, Chase Terrace, Walsall WS7 8AS.

Birmingham Computer Club meets at CBS Consultants, Watery Lane, Small Heath, Birmingham, on the first and third Wednesday every month.

Contact Dr Mike Bayliss, 125 Berrfield Road, Sheldon, Birmingham B26 3UU, tel: 021-743 7197.

National Westminster Personal Computer Society.

Contact P Moore 021-236 6176, ext 382.

WILTSHIRE

Chippenham and Calne, proposed new club.

Contact Matthew Jones, Pinhills, Calne SN11 0LY

WORCESTER

Worcester & District Computer Club meets at Old Pheasant Inn, New Street, Worcester, on the second Monday every month at 8pm.

Contact D Stanton, 55 Vauxhall Street, Rainbow Hill, Worcester WR3 8PA.

WOLVERHAMPTON

Central Program Exchange, annual subs: full membership £25 Europe, small users service £10 Europe.

YORKSHIRE

Barnsley Co-Operative Computer User Group meets at Co-Op Social Club, Pogmore, Barnsley, on the last Tuesday every month at 7.30pm. Annual subs £1.

Contact James Bridson, c/o 39 Keresforth Hall Road, Barnsley, South Yorks S70 6NF, tel: 0226-41753.

Doncaster Amateur Computer Society meets in YMCA, Wood Street, on the first Wednesday every month.

Contact John Wilkinson, 316 Bawtry Road, Doncaster, S. Yorkshire, tel: 0302-868379.

York Computer Club meets at the Enterprise Club every Monday at 8pm.

Contact K Thomas, Green Lea, Ripon Road, Harrogate, North Yorkshire HG1 2BY, tel: 0904-38239.

Program Power, contact R Simpson, 5 Wemsley Road, Leeds LS7 2BX, tel: 0532-683186

Shipley College Computer Group meets on Tuesdays. Contact Paul Channell, 0274-595731.

South Yorkshire Personal Computer Group meets at General Lecture Theatre, St Georges Building, Mappin Street, Sheffield, on second Wednesday every month at 7.30pm. Annual subs: £4.

Contact Paul Sanderson, 8 Vernon Road, Tetley, Sheffield S17 3QE.

Pennine & District Computer Club meets at 26 Mill Hey, Haworth, W Yorks, on Saturday and Sunday.

Contact Douglas Bryant, 26 Mill Hey, Haworth, W Yorkshire, tel: 0535-43007.

West Yorkshire Microcomputer Group meets on Tuesdays.

Contact Phillip Clark, c/o Suite 204, Crown House, Armley Road, Leeds LS12 2ES, tel: 0532-632532.

Huddersfield Computer Club meets every Monday. Contact Chris Townsend, 760/4 Manchester Road, Linthwaite, Huddersfield, tel: 0484-657299.

Leeds Microcomputer Users Group meets at 8 Regent Street, Chapel Allerton, fortnightly on Thursday at 6pm.

Contact David Parsons, 22 Victoria Walk, Horsforth LS18 4PL.

Greenhead Grammar School Computer Club.

Contact Brian Smith, Greenhead Road, Keighley, West Yorks BD20 6EB, tel: 0535-62828.

81 Club annual subs: £30+vat.

Contact Mike Hayes 0222-371732.

SCOTLAND

Kemnay Computer Club meets weekly.

Contact S Stubbs, 15 The Glebe, Kemnay, Inverurie, Aberdeenshire.

Central Scotland Computer Club meets at Falkirk College Of Technology, Grangemouth Road, Falkirk, on the first and third Thursday every month.

Contact James Lyon, 78 Slamannan Road, Falkirk FK1 5NF.

Scottish Amateur Computer Society, contact Mike Anthony, 46 Moredun Park Gardens, Edinburgh EH17 7JR.

Fife Computer Users Club.

Contact Murray Simpson, 31 Tom Steward Lane, St Andrews, Fife, Scotland KY16 8YB.

Grampian Amateur Computer Society meets at 35 Thistle Lane, Aberdeen, on the second and fourth Monday every month at 7.30pm. Annual subs: £12, £5 student, £2.50 junior.

Contact Alan Morrison, 21 Beech Road, Westhill, Skene, Aberdeenshire AB3 6WR.

Skye and Lockalsh Computer Society, proposed new club.

Contact C Manvell, 25 Breacais Isol, Isle of Skye IV42 8QA.

Strathclyde Computer Club meets at Wolfson Centre, 106 Rottenrow, Glasgow, on the third Wednesday of every month.

Contact B Duffy, 24 Lomand Drive, Condorrat, Cumbernauld G4 8NW.

Perth & District Amateur Computer Society meets at Hunters Lodge Motel, Bankfoot, on the third Tuesday of every month at 7.30pm. Annual subs £5.

Contact Alastair McPherson, 154 Oakbank Road, Perth PH1 1HA.

WALES

Gwent Amateur Computer Club meets at St Mary's Institute, Stow Hill, every Thursday at 7.30pm. Annual subs: £3.50.

Contact Rothery Harris, 16 Alanbrook Avenue, Newport, Gwent, Wales NPT 6QJ.

Swansea & Southwest Wales Amateur Computer Club meets on the last Friday every month.

Contact Paul Griffiths, 1 Prescelli Road, Penlan, Swansea SA5 8AF.

Colwyn Computer club meets at the Greens Hotel, Colwyn Bay, at 7pm.

Contact D Bevan, c/o Abergele Road, Colwyn Bay, Clywd LL29 7PA.

Abergele Computer Club meets at Abergele CI Offices every Thursday at 7.30-10pm. Annual subs: £5 adults, £2.50 juniors.

Contact W Jones, 77 Millbank Road, Rhyl, Clwyd, North Wales.

Pontypool Computer Club meets at The Settlement, Roackhill Road, Pontypool, Gwent, on every Friday.

Contact Graham Loveridge, on Pontypool 2827.

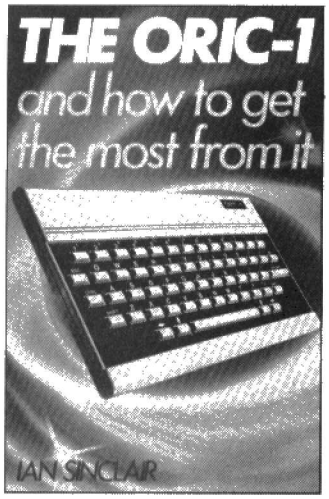
EIRE

Cork Amateur Computer Club. Talks and demonstrations. Hardware, programming and games.

Contact T Moriarty, Tiger Bay, Rochestown, Douglas, Cork, Eire.

Remember

Let us know about your micro club or user group so we can be sure the information printed here is up to date. Drop a card to Sandra Grandison, Listings Editor, at *Personal Computer News*. 62 Oxford Street, London W1A 2HG, or give her a call on 01-636 6890.



'The Oric 1 and how to get the most from it' by Ian Sinclair, published by Granada at £5.95 (paperback, 136 pages)

It's Oric's fault. If manufacturers stopped their selfish practice of marketing products with awful manuals then we wouldn't need books like this one.

Ian Sinclair's book is yet another of those rushed pulp jobs that saves the hapless beginner from rotten documentation. It may be a sad fact, but if you know nothing about computing *The Oric-1* could actually help.

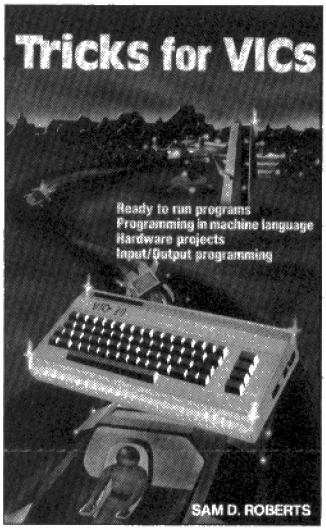
Mr Sinclair goes through the basics of using the machine. The first section of the book is about the core of Basic and is general enough to be adaptable to several micros. Only the last few chapters and appendices deal with Oric-specific stuff such as sound and graphics.

The book isn't easy to use, breaking down into large chunks that often don't follow the chapter breaks referred to in the text. Mr Sinclair is less detailed than the Oric manual and skimps on the points that need explaining, such as the display attributes.

It's not the reference bible that the publishers seem to believe it is. There's not enough information to allow you to progress very far. Mr Sinclair even makes mistakes such as claiming INT (—23.6) = —23. If only he had checked it on an Oric!

Worst of all, his book is so rushed that he had to work with a pre-production Oric — he continually admits there might be differences from the Oric you buy in the shops. So there's no reference to any of the bugs that still infest the Oric Basic.

If you are new to computing and you've bought an Oric, then a look at Ian Sinclair's book should get you going. But take it in the spirit it was meant. Borrow a copy from a friend. **MP**



'Tricks for Vics' by Winfried Hofacker published by Ing. W Hofacker (paperback, 116 pages).

This book, proclaims the author/publisher, 'is published as a service to Vic-20 personal computer users worldwide.'

Well, 'service' is not quite the right word.

In the preface Herr Hofacker also says he has to thank 'Franz Ende for the translation'. Again, 'thank' is not quite the right word. As an example I offer the following from a section on programming for use with joysticks:

'You should get a value of 243 if the button on the right joystick is depressed. Be aware that the same value will also appear if you move the right joystick to the east and west simultaneously. This is physically impossible and the programmer has to rectify this situation.'

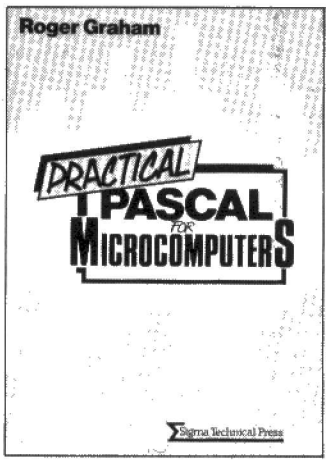
A nice trick if you can do it.

On the face of it, *Tricks for Vics* offers good value for money with more than a dozen ready-to-run programs, an introduction to machine code, input/output programming and a section of hardware projects.

The latter offers a 16K RAM-ROM board and an experimenter board which Herr Hofacker (via translator Ende) assures us 'gives you the permission to connect external expansions'.

There is a fair selection of programs here, including a word processor in 8K, a simple machine code monitor and a range of games. But I can't recommend you to follow the book into hardware experimentation. This is risky in the best of circumstances for anyone with less than a solid grounding in electronics. That coupled with the additional dangers of the translation make for an adventure fraught with the risk of destruction.

On the whole there are better books for Vic owners worth the investment of a few pounds. And it's desconcerting to observe the schizophrenic authorship: the cover bills the author as Sam D Roberts, but inside it's all Herr Hofacker. **PW**



'Practical Pascal for Microcomputers' by Roger Graham, published by Sigma Technical Press at £7.50 (paperback, 200 pages)

This book is more for the enthusiast than the beginner. If you have already decided that you wish to program in Pascal and want to find out how then you will find the book useful.

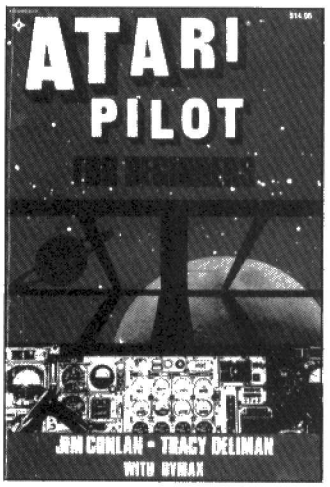
But if you have no knowledge of Pascal and want to discover what it is all about this book may put you off.

Not that Roger Graham is lacking in his grasp of the subject. On the contrary, he demonstrates a full understanding of the complexities of the language.

The problem is that he presents the material in a dull style. And he is not helped by the design and layout of the book, which is equally boring.

The treatment of the subject is full if not comprehensive. Program design and structures are covered, as are mathematical functions and record types. The section on disk files is, however, somewhat cursory.

As befits the title, the text is amplified by the generous use of example programs. It is therefore a book that encourages learning by doing rather than by reading. **RB**



'Atari Pilot for Beginners' by Jim Conlan and Tracy Deliman, published by Prentice-Hall International at £11.95 (paperback, 230 pages)

Aimed at children and adults who wish to learn about computers, *Atari Pilot For Beginners* is a manual-type book which presents you with a step by step guide to using Pilot on the Atari.

The whole object of Pilot (Programmed Inquiry Learning or Teaching) is the turtle, which accepts commands to draw on the screen.

In this book you learn about the Atari 400 and 800 micros, and how to use the Pilot commands on these machines. In no time, you will be able to make 32 sounds related to the piano and draw some simple graphics.

Each chapter is set out to a standard format, with an introductory section telling you what you are about to learn, then a series of text/screen diagram lessons, a self-test section, and finally a brief section telling you what you have (or should have) learned.

The book is intended to let the beginner learn to use computers through play and experimentation with programming. This means, in effect, that it combines fun programming with learning, and slightly humourous illustrations with serious information.

If you do work your way through it properly, you'll certainly find yourself knowing a good deal more than you did when you started.

But at £11.95 Jim Conlan and Tracy Deliman's paperback is overpriced for what it offers. And there's one subtle point — it's not worth buying if you haven't got the Pilot cartridge. **SG**

DATABASICS

This five-page guide lists as many of the micros on the market for under £12,000 as possible. In Databasics you'll find all the specifications for the machines, add-ons and software necessary to make your buying decisions.

PCN keeps you up to date in three-week cycles, starting with hardware, then peripherals and finally software.

PRICE Specifications listed for each machine indicate what you get for the basic price quoted, which includes VAT.

PROCESSOR TYPE a microprocessor is the heart of the computer. The Z80 and 6502 are popular 8-bit chips. The 8088 and 68000 are common 16-bit chips. If a machine has an 8-bit and a 16-bit processor we have listed the 16-bit only. Cust. means custom-built.

SPEED IN MHz Speed of the clock used to drive the microprocessor, measured in MegaHertz (thousand cycles per second).

STANDARD RAM Amount of main memory used on the system. The capacity is expressed in kilobytes.

MAX RAM normally at extra cost Amount of memory to which the system can be expanded.

MAX CHARACTERS columns × lines The number of characters that can be displayed across the screen and the number of lines down.

METHOD (at extra cost) This indicates the way the computer displays information. **M** on its own means that a monitor is included in the basic price. **Tv** indicates that you can plug the computer into a television set (**M+**) indicates that the monitor costs extra. **LCD** = Liquid crystal display.

COLOUR CAPABILITY tells you whether the machine can give colour at the basic price quoted.

MAX DOT RESOLUTION gives the maximum number of points across the screen by the number of points down the screen that are available for graphics.

KEYBOARD This tells you the type of keyboard that comes with the machine. **W** = word processing, **C** = calculator and **T** = touch-sensitive.

No OF FUNCTION KEYS refers to the number of keys that can be used for different jobs by different programs.

NUMERIC PAD indicates whether the machine has a separate calculator-style group of number keys to enter data quickly.

INTERFACES BUILT-IN shows the number of standard connections built into the machine.

CASSETTE FACILITY gives a yes or no as to whether or not the machine can use a cassette to store data.

CAPACITY PER DISK AND DISK SIZE tells you how many disk drives come with the machine, and the amount of data in kilobytes (K) or megabytes (Mb) that can be stored on each drive. There are two sizes for disks, 5¼" or 8", and they can be floppy **(F)** or hard **(H)**.

OPERATING SYSTEM gives the program that looks after the general running of a computer.

LANGUAGES INC is a column which lists the programming languages that come with the machine at the basic price.

OTHER LANGUAGES AVAILABLE indicates whether or not other programming languages are available for the machine.

DISTRIBUTOR To find which company distributes the machine refer to the distributor table from the code listed in this column. The table is at the end of the listings, and gives the distributor's name and telephone number.

All details given are the latest available. We ask distributors to let us know as soon as machine specifications change so Databasics can be kept right up to date. This guide has been meticulously researched and the information collected from individual distributors listed.

PRICE GUIDE

Sinclair ZX81	£50	Commodore 4016	£632	Transam Truscan	£1,983	LSIM4	£2,472	DECPC 325	£3,080	Corvus Concept	£4,887
Tandy TRS-80 Pocket	£57	Research Machine 480Z	£650	IDS Datamachine	£1,995	Canon CX-1	£2,500	Direct 1000	£3,093	ICL PC Model 31	£4,939
Sharp PC1251	£80	DAI PC	£684	Tandy TRS-80 Model	£1,999	Adler Alphatronic P2U	£2,524	Equator	£3,099	Cromemco System 3	£5,170
Jupiter Ace	£90	Apple II	£776	Kenilworth 83N	£2,012	IO Tech Iona	£2,539	Clenio Table-Tops 925	£3,105	Micro Five 1000	£5,175
Casio FX702P	£90	Commodore 500	£799	Caltext Micro	£2,019	HP 87XM	£2,571	ITT 3030	£3,105	Fortune 32:16 System 2	£5,204
Oric 1	£100	HP 75C	£883	LSIM3	£2,064	Quantum 2000	£2,587	Monroe OC 8810	£3,162	Zeus 4	£5,400
Sinclair Spectrum	£125	Sharp MZ80B	£900	Haywood 9000 Composite	£2,064	Seed System 19	£2,600	HP Series 200 Model 16A	£3,211	Hawk Model 2110	£5,405
TIT1-99/4A	£150	Commodore 8032	£1,129	Hawk Model 110	£2,070	Enterprise 1000	£2,645	Samurai	£3,214	Molecular M200	£5,462
Atari 400	£160	Commodore 710	£1,144	Positron 9000	£2,134	Facit 6520	£2,645	Torch	£3,214	Altos 800/15	£5,663
Commodore VIC 20	£170	Microdecision	£1,144	Research Machines 380Z	£2,147	Olympia Boss Model A	£2,645	Sord M223	£3,277	Durango F85	£5,744
Sharp PC1500	£170	Fujitsu FM8	£1,150	Future Computers FX-20	£2,156	Britannia Baby	£2,657	Kontron RS180	£3,306	Marin Chip M9900	£5,750
Acorn Atom	£174	Sanyo MBC 1000	£1,195	Comart Communicator	£2,180	Adler Alphatronic P3	£2,696	Columbia PC 1600-1	£3,392	SW Tech. Products S0/9	£5,750
Tandy TRS-80 Pocket 2	£179	Positron 900	£1,259	Adler Alphatronic P2	£2,197	Eagle II	£2,702	Digico Prince	£3,392	BASF 7100	£5,805
Tandy TRS-80 Model 1	£199	Commodore 8096	£1,374	Genei III	£2,242	Almarc 801	£2,708	Barcellos AMT 100	£3,450	Sord M243	£5,842
Dragon 32	£200	Pasca 640	£1,437	Kemitron K2000E	£2,242	DEC Rainbow 100	£2,714	Kalamazoo 1050	£3,450	Archives IV	5,905
Sord M5	£218	NEC PC8000	£1,454	Rair Black Box 320S	£2,242	ICL PC Model 10	£2,754	Cromemco System 2	£3,560	ICL PC Model 32	£6,037
Colour Genie	£224	Irvine Business Systems	£1,489	Sanyo MBC 2000	£2,242	Millbank SX10	£2,754	Digital Microsystems 3	£3,576	Rair Business Computer	£6,037
Camputers Lynx	£225	Televideo TS-800 Series	£1,495	Toshiba T-200	£2,242	Olivetti M20D	£2,754	Decision-1 Computer 012	£3,674	Digital Microsystems 4	£6,210
Tandy TRS-80 Colour	£240	HP 86A	£1,541	TMK 332	£2,242	Sirius I	£2,754	Televideo TS 1602-C	£3,714	Superstar	£6,296
New Brain A	£269	Osborne I	£1,581	Bonsai SM 3000	£2,294	Victor 9000	£2,754	Adds Multivision	£3,795	Racal 6000	£6,327
BBC Micro Model A	£299	Signet 10025	£1,599	CAL PC	£2,294	North Star Advantage	£2,766	Clenio Pronto	£3,795	Eagle 1600	£6,497
Genie II	£299	APL Signet	£1,610	North Star Horizon	£2,294	Apple III	£2,780	Panasonic JD800M	£3,795	TI System 200-250	£6,695
Multitech MPS II	£299	Zenith Z89-81	£1,668	Sanyo MBC 1250	£2,294	Sanyo MBC 4050	£2,817	Kemitron K3000	£3,795	Compucorp 675	£6,780
Nascom 2	£327	Basis 108	£1,683	Casu Mini C2	£2,300	Bonsai SM 4000	£2,842	DEC PC 350	£3,850	Sundance I	£6,969
Genie I	£330	Tandy TRS-80 Model III	£1,699	Seed System I	£2,300	Logica VTS Vitesse	£2,863	Vector 4	£3,852	Pascal Mod. Microengine	£7,003
Commodore 64	£345	Commodore Spr. Pet 9000	£1,719	Sharp PC3201	£2,300	Decision-1 Computer O11	£2,869	Sage II	£4,019	Diablo 3000	£7,250
BBC Micro Model B	£399	Gemini Galaxy 2	£1,719	HP 85	£2,360	Eagle III	£2,950	Eagle IV	£4,190	Onyx 5001 MU	£7,607
Atari 800	£400	British Micro Mini 803	£1,720	HP Series 100, 120	£2,362	Zenith Z89-81	£2,978	C-1010	£4,197	Sundance II	£8,205
Datac Micro Controller	£431	Microsolution Brit. Genius	£1,840	Sord M23P	£2,369	Monroe EC 8800	£2,990	Tandy TRS-80 Model 16	£4,199	Haywood Hinet	£9,550
Cortex	£454	Toshiba T-100	£1,900	IBM PC	£2,392	Philips P3500	£3,000	Hytech H4500	£4,310	Altos 856-10	£9,631
Epson HX20	£472	Sord M23	£1,932	Superbrain JR	£2,403	Tanberg EC10	£3,000	BMC OK11F800, Model 20	£4,360	Micro Five 3000	£10,350
Nascom 3	£549	Transtec BC2	£1,949	Xerox 820 Model II	£2,415	Archives 1	£3,003	ADS 42	£4,500	Sundance 16	£10,480
Sharp MZ80A	£549	Kenilworth 83G	£1,953	Haywood 3000	£2,439	Cromemco System 1	£3,025	Televideo TS-80ZH	£4,533	Spectrum	£11,442

ABBREVIATIONS

Ap: APL
As: Assembly
Ba: Basic
Co: Cobol
Cm: Comal
Fr: Forth
Fn: Fortran
Pa: Pascal

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Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display			Graphics	Keyboard			Interfaces built-in					Storage		Operating system	Languages inc	Other languages available	Distributor	Comments
						Max characters columns × lines	Method (at extra cost)	Colour capability	Max dot resolution	Type of keyboard	No. of function keys	Numeric pad	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others	No. of expansion slots	Cassette facility	Capacity per disk and disk size					
Acorn Atom	£174	6502	1	2K	40K	32×16	Tv(M+)	●	256×192	W							1	●		Cassette	BaAs	●	A1	Hobbyist micro
Adds Multivision	£3,795	8085A	5	64K	256K	80×25	M		640×240	W	28		1			1			1×350K5¼F	CP/M2.2, Muon	Ba	●	A2	Multi user system
Adler Alphatronic P2	£2,197	8085A	3	48K	64K	80×24	M			W	6	●	2			1	3		2×160K5¼F	CP/M	Ba	●	T1	Good software choice
Adler Alphatronic P2U	£2,524	8085A	3	64K		80×24	M			W	6	●	2			1	3		2×320K5¼F	CP/M	Ba	●	T1	£327 buys extra storage
Adler Alphatronic P3	£2,696	8085A	3	64K		80×24	M			W	6	●	2			1	3		2×790K5¼F	CP/M		●	T1	16 bit option-promised
ADS 42	£4,500	8085A	4	32K		40×8	M		40×8	W		●	3				3	●	1×82K5¼F	Holland Automation	Ba		A3	Intelligent cash register
Almarc 801	£2,708	Z80	4	64K	512K	80×25	(M+)	●		W			2				11		2×800K5¼F	CP/M		●	A4	8-bit range goes to 20Mb
Almarc 1601	£3,445	8086	8	128K	1Mb	80×25	(M+)	●		W			2				11		2×800K5¼F	CP/M86		●	A4	Pseudo 16-bits go to 20Mb
Altos 800/15	£5,663	Z80	4	192K	208K	80×24	M			W	8	●		1					1×450K5¼F	MP/M		●	L1	Multi user business machine
Altos 856-10	£9,631	8086	10	512K	1Mb	80×24	M			W	16	●	6						2×500K5¼F	Xenix	Xenix	●	L1	The 16-bit version
APL Signet	£1,610	Z80A	4	64K		80×25	Tv(M+)*	●		*			2						2×188K5¼F	APL, CP/M	Ap	●	M1	*APL terminal recommended
Apple II	£776	6502	1	48K	128K	40×24	Tv(M+)	●	256×192	W							8	●		CP/M, DOS 3.3, UCSD-P	Ba	●	A8	Plenty of software and extras
Apple III	£2,780	6502	2	128K	256K	80×24	(M+)	●	560×192	W		●	1				4		1×140K5¼F	SOS, DOS		●	A8	Will emulate Apple II
Archives I	£3,003	Z80	4	64K		80×25	M	●	240×100	W	23	●	2	1		1	5		2×386K5¼F	CP/M		●	S1	Standard CP/M + graphics
Archives IV	£5,905	Z80	4	512K		80×25	M	●	240×100	W	23	●	1			1	3		1×10Mb5¼H+1×7445¼F	CP/M, MP/M		●	S1	Hard disk version
Atari 400	£160	6502B	1.79	16K		40×24	Tv	●	320×160	T						7		●		Cassette		●	A5	Games computer, Basic extra
Atari 800	£400	6502	1.8	16K	48K	40×24	Tv(M+)	●	320×192	W						7	4	●		Cassette	Ba	●	A5	Versatile, good graphics
Barcellos AMT 100	£3,450	Z80A	4	64K	256K	80×24	TvM			W	8	●	1	1		2	3		2×500K8F	CP/M	BaCo	●	B1	Up to four users
BASF 7100	£5,805	Z80A	4	64K		80×24	M			W	26	●	1	1					3×163K5¼F	BOS	Ba	●	C1	Hard disc promised
Basis 108	£1,683	6502	1	64K	126K	80×24	TvM	●	820×168	W	15	●	1	1			6	●				●	C12	Apple bus, Z80, 80 columns
BBC Micro Model A	£299	6502	1.8	16K	32K	40×30	Tv(M−)	●	320×256	W	10					1		●		MOS	BaAs	●	A1	Upgradable to Model B
BBC Micro Model B	£399	6502	2	32K		80×30	Tv(M−)	●	640×256	W	10			1		5	3	●		MOS	BaAs	●	A1	Versatile and expandable
BMC OKI if 800, Model 20	£4,360	Z80B	5	64K	256K	80×25	M	●	640×200	W	15	●	1					●	2×340K5¼F	CP/M	Ba	●	E1	Built-in printer
Bonsai SM 3000	£2,294	Z80	2	64K		80×24	M		80×24	W	14	●	1	1					2×350K5¼F	CP/M		●	B2	CP/M business machine
Bonsai SM 4000	£2,842	8088	5	128K	256K	80×24	M			W	14	●	1	1						CP/M, MP/M, MS-DOS		●	B2	Z80 for 8 bit software
Britannia Baby	£2,657	8085	6.14	64K		80×25	Tv(M+)		80×25	W	11	●	2	1					2×500K5¼F	CP/M	AsBaCo	●	B3	Cobol language included
British Micro Mimi 803	£1,720	Z80A	4	64K		80×25	(M+)		512×256	W	17	●	1	1		1			2×400K5¼F	OS/M		●	B4	This is CP/M compatible
C-1010	£4,197	6502	1	64K	128K	80×24	TvM		256×192	W	12	●	1	1		1	8	●	1×1405¼F+1×10MbH	CP/M, DOS, UCSD-P	Ba	●	C2	Apple II compatible
CAL PC	£2,294	8088	5	128K	256K	80×25	TvM	●	256×512	W		●	2	1		1	5		2×400K5¼F	CP/M	Ba	●	C3	Also Z80B Processor
Caltext Micro	£2,019	Z80A	4	64K	256K	80×24	TvM			W	36	●	1	1			3		2×400K5¼F	CP/M		●	C3	Range of software included
Camputers Lynx	£225	Z80A	4	48K	192K	40×24	Tv(M+)	●	248×256	W			1	1				●		Cassette	Ba	●	C5	Unusual — promise of CP/M
Canon CX-1	£2,500	6809	4	128K	256K	80×24	M		80×25	W	15	●	3	1	1		2		2×320K5¼F	MCX	BaAs	●	C4	Pascal, Fortran as extras
Casio FX 702P	£90	Cust.		2K		20×1	LCD			C								●		Cassette	Ba		C6	Pocket computer
Casu Mini C2	£2,300	Z80A	4	64K		*	(M+)		*	*			4	1			6		2×1Mb8F			●	C7	*Choose your own terminal
Clenlo Pronto	£3,795	Z80A	4	64K	1Mb	*	Tv(M+)		*	*			2	2			18		2×600K8F	CP/M	Ba	●	C8	*Choice of terminal
Clenlo Table-Top 925	£3,105	Z80A	4	64K	128K	80×25	M			W	11	●	2	2					2×600K8F	CP/M		●	C8	Watch out for the weight
Columbia PC1600-1	£3,392	8088	4.77	128K	1Mb	80×24	M	●	640×200	W	10	●	2	1			8		2×320K5¼F	CP/M, MS-DOS	Ba	●	I1	An IBM lookalike
Commodore VIC 20	£170	6502	1	5K	32K	22×23	Tv(M+)	●	176×158	W	8					3	1	●		Kernal	Ba	●	C9	Very popular home micro
Commodore 64	£345	6510	1	64K		40×25	Tv(M+)	●	320×200	W	8					3		●		Kernal	Ba	●	C9	Good value for money
Commodore 500	£799	6509	1	128K	896K	40×25	Tv(M+)	●	320×200	W	10	●	1		1	3	1	●		Kernal	Ba	●	C9	Available by summer?
Commodore 4016	£632	6502	1	16K	32K	40×25	TvM			W		●			1	1	3	●		Cassette, PETDOS	Ba	●	C9	The original PET
Commodore 710	£1,144	6509	2	128K	896K	80×25	TvM			W	10	●	1		1	2	1	●		Kernal	Ba	●	C9	Might be a long wait
Commodore 8032	£1,129	6502	1	32K	96K	80×25	TvM			W		●			1	1		●		Cassette, PETDOS	Ba	●	C9	The 80-column PET
Commodore 8096	£1,374	6502	1	96K		80×25	TvM			W		●			1	1		●		Cassette, PETDOS	Ba	●	C9	Fully expanded PET
Commodore Super Pet 9000	£1,719	6502	2	96K		80×25	TvM			W		●	1		1	1	2	●		Cassette, PETDOS	Ba	●	C9	Top of the range
Compucorp 675	£6,780	Z80	4	64K	256K	80×20	M			W	20	●	1				4		2×655K5¼F	Compucorp		●	C10	Unusual O/S
Comart Communicator CP100	£2,180	Z80	4	64K	512K	80×24	M			W		●	2	1			10		2×390K5¼F	CP/M		●	C13	Business CP/M micro
Cortex	£454	9995	12	64K	1Mb	40×24	Tv(M+)	●	256×192	W	12	●	1					●			BaAs		M2	Mainly sold as £340 kit
Corvus Concept	£4,887	68000	8	256K	1Mb	120×60	M		720×560	W	10	●	2			1	4			Merlin	Pa	●	K1	A4 shaped screen

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Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display			Graphics	Keyboard			Interfaces built-in					Storage		Operating system	Languages inc	Other languages available	Distributor	Comments
						Max characters columns × lines	Method (at extra cost)	Colour capability	Max dot resolution	Type of keyboard	No. of function keys	Numeric pad	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others	No. of expansion slots	Cassette facility	Capacity per disk and disk size					
Cromemco System 1	£3,025	Z80	4	64K		80×24	(M+)	●	450×735	W	20	●	1				8		2×390K5¼F	CDOS, Crom		●	C13	Designed for business
Cromemco System 2	£3,560	Z80	4	64K		80×25	(M+)			W	20	●	1				21		2×390K5¼F	CDOS, Crom		●	C13	Large business machine
Cromemco System 3	£5,170	Z80	4	64K		80×25	(M+)			W	20	●					21		2×1.2Mb8F	CDOS, Crom		●	C13	Top end Cromec
DAI PC	£684	8080	2	48K		60×24	Tv(M+)	●	255×335	W			1					●		Cassette	Ba		D9	Optional maths chip
Datac Micro Controller	£431	Z80	2	16K		40×24	Tv(M+)		80×60	W			1			1	1	●			Ba	●	D1	Mainly used in labs
DEC Rainbow 100	£2,714	8088	N/A	64K	192K	132×24	M	●	960×240	W	20	●	2				3		2×400K5¼F	CP/M		●	D2	Competitor for IBM PC
DEC PC 325	£3,080	PDP11/23	N/A	256K		132×24	M	●	960×240	W	20	●	2				1		2×400K5¼F	P/OS		●	D2	Mini in micro clothing
DEC PC 350	£3,850	PDP11/23	N/A	256K		132×24	M	●	960×240	W	20	●	2				4		2×400K5¼F	P/OS		●	D2	Mini in micro clothing
Decision-1 Computer MDC-011	£2,869	Z80A	4	64K	192K		(M+)*			*			3	1		1			2×400K5¼F	CP/M	Ba	●	I2	*Buy your own terminal
Decision-1 Computer MDC-012	£3,674	Z80A	4	64K	192K		(M+)*			*			3	1		1			1×400K5¼F+1×5Mb5¼H	CP/M	Ba	●	I2	*You choose the terminal
Diablo 3000	£7,250	8085	3	32K	64K	80×24	M			W	8	●	1				4		2×1.8Mb8F	DACL	Ba	●	B5	Unusual O/S
Digico Prince	£3,392	Z80A	4	64K		80×25	M			W	50	●	2				7		2×400K5¼F	CP/M		●	D3	Unusual keyboard
Digital Microsystems DMS-3	£3,576	Z80A	4	64K			(M+)*			*			3			1			2×512K8F	CP/M		●	D4	*Choice of terminal
Digital Microsystems DMS-4	£6,210	Z80A	4	128K	½Mb		(M+)*			*			4						2×512K8F	MP/M		●	D4	*Depends on terminal chosen
Direct 1000	£3,093	Z80	4	64K		80×25	M		132×28	W			2						2×300K5¼F	CP/M		●	D5	Standard CP/M machine
Dragon 32	£200	6809E	1	32K	64K	32×16	Tv(M+)	●	256×192	W				1		4	1	●		Cassette	Ba		D6	Tandy colour lookalike
Durango F85	£5,744	8085A	5	64K	196K	80×64	Tv(M+)			W		●	4			1	12		2×1Mb5¼F	Star Basic	BaCo	●	C3	Built in printer
Eagle II	£2,702	Z80A	4	64K		80×24	M		80×24	W		●	2	1		1			2×500K5¼F	CP/M	Ba	●	M3	Includes WP/SS software
Eagle III	£2,950	Z80A	4	64K		80×24	M		80×24	W		●	1						2×1Mb5¼F	CP/M	Ba	●	M3	Includes WP/SS software
Eagle IV	£4,190	Z80A	4	64K		80×24	M			W		●	2	1		1			1×1Mb5¼F+1×12.5Mb5¼H	CP/M	Ba	●	M3	Includes WP/SS software
Eagle 1600	£6,497	8086	8	128K	512K	80×25	M	●	720×352	W	24	●	2	1		1	8		1×1Mb5¼F+1×12.5Mb5¼H	MS-DOS, CP/M 86		●	M3	High speed IBM copy
Enterprise 1000	£2,645	*	8	64K			M			W	10	●	2			2			2×358K5¼F	Enterprise		●	D7	Micro Nova 16-bit
Epson HX20	£472	6301	1	16K	32K	20×4	LCD		120×32	W	13	●	2				2	●		Cassette	Ba		E2	Powerful portable
Equator	£6,842	Z80A	4	64K	448K	80×24	M		255×560	W	14	●	7	1		1	8		1×5Mb5¼F+1×750K5¼F	CP/M, MP/M, Turbo DOS		●	E3	Two bigger models available
Facit 6520	£2,645	Z80	4	64K	128K	80×24	M		80×24	W	8	●	2						2×320K5¼F	CP/M, Facit DOS	Ba	●	F1	Concurrent printing
Fortune 32:16 System 2	£5,204	68000	6	256K	1Mb	80×24	M	●	1024×1024	W	16	●	1				20		2×800K5¼F	Unix		●	I3	Genuine 16-bit
Fujitsu FM8	£1,150	6809	1	64K		80×25	(M+)	●	640×200	W	10	●	1	1		4	1	●		Flex	Ba		S2	Good for business graphics
Future Computers FX-20	£2,156	8088	8	128K	1Mb	80×25	M		800×400	W	20	●	2			2			2×800K5¼F	CP/M 86, MS-DOS		●	E1	Still on a promise
Genie I	£330	Z80	1.7	16K	48K	64×16	Tv(M+)		128×48	W			1	1			1	●		Cassette	Ba	●	L2	Compatible with TRS 80/I
Genie II	£299	Z80	1.7	16K	48K	64×16	Tv(M+)		128×48	W	4	●	1				1	●		Cassette	Ba	●	L2	Speeded-up Genie I
Genie III	£2,242	Z80A	3.2	64K		80×24	M		160×72	W	8	●	1	1		1	3		2×700K5¼F	New DOS	Ba	●	L2	CP/M costs extra
Colour Genie	£224	Z80	2.2	16K	32K	40×24	Tv(M+)	●	160×96	W	8		1	1		2	1	●		Cassette	Ba		L2	Home games machine
Gemini Galaxy 2	£1,719	Z80	4	64K	512K	80×25	M		160×75	W	10	●	1	1		1	5	●	2×400K5¼F	CP/M		●	G1	Low cost British system
Hawk Model 110	£2,070	Z80A	4	64K	256K	*	(M+)*	●	*	*			2	1			3		2×390K5¼F	CP/M, MP/M2		●	L6	*Choose your terminal
Hawk Model 2110	£5,405	Z80A	4	64K	256K	*	(M+)*	●	*	*			2	1			3		1×390K5¼F+1×21MbH	CP/M, MP/M2		●	L6	*Choose your terminal
Haywood 9000 Composite	£2,064	Z80A	4	64K	192K	80×25	M		64×255	W	34	●	2				8		2×320K5¼F	CP/M	As	●	H1	Designed for network
Haywood Hinet	£10,982	Z80	4	64K	128K	80×24	M			W	34	●	3	1		1			1×11Mb8H	CP/M		●	H1	Large network machine
HP 75C	£883	Cust.	N/A	16K	24K	32×1	(M+)			C						1	4	●	1.3K card reader	HP	Ba		H2	Calculator/computer
HP 85	£2,360	Cust.	N/A	16K	32K	32×20	M		255×191	W	8	●	1			4	4	●		Cassette	Ba	●	H2	Engineers' machine
HP 86A	£1,541	Cust.	N/A	64K	512K	80×2[illegible]	M		544×240	W			1	1		2	4			HP	Ba	●	H2	CP/M optional
HP 87XM	£2,571	Cust.	N/A	128K	640K	80×2[illegible]	M		544×240	W	14	●	1	1	1	3	4			HP DOS	Ba	●	H2	Special technical uses
HP Series 100, 120	£2,362	Z80A	3.68	64K		80×24	M		80×24	W	8	●	2			1				CP/M	Ba	●	H2	Top end HP business system
HP Series 200 Model 16A	£3,212	68000	8	128K	750K	80×25	M			W	5		1		1		2			HP		●	H2	Genuine 16-bit
Hytech H4500	£4,310	Z80	4	64K	208K	80×25	M		80×25	W	26	●	1				3		2×403K5¼F	CP/M	Ba	●	H3	Standard CP/M micro
IBM PC	£2,392	8088	4.7	64K	576K	80×25	(M+)	●	640×200	W	10	●		1			5		1×360K5¼F	MS-DOS	Ba	●	K2	Slow but reliable
ICL PC Model 10	£2,754	8085	3	64K	256K	80×24	Tv(M+)			W	11	●	2				8		2×700K5¼F	CP/M	Ba	●	I4	Repackaged Rair Black Box
ICL PC Model 31	£4,939	8085	3	128K	256K	80×24	(M+)		80×24	W	11	●	4				8		1×250K5¼F+1×5MbH	CP/M, MP/M	Ba	●	I4	Multi user Black box
ICL PC Model 32	£6,037	8085	3	256K		80×24	(M+)		80×24	W	11	●	8				8		1×250K5¼F+1×5MbH	CP/M, MP/M	Ba	●	I4	Top of ICL range
IDS Datamachine	£1,995	Z80	4	64K	1Mb	*	Tv(M+)		*				2				15		2×400K5¼F	CP/M	Ba	●	I8	*Depends on terminal

IO Tech Iona	£2,539	Z80	4	69K	960K	80×24	M	●	160×75	W	12	●	1	1			8	●	2×400K5¼F	CP/M		●	I5	Good colour versatility
Irvine Business Systems	£1,489	Z80	4	64K		80×25	M			W		●	2						2×400K5¼F	CP/M		●	I6	Inexpensive CP/M machine
ITT 3030	£3,105	Z80A	4	64K	256K	80×24	Tv(M+)		80×24	W	8	●	1			1	1		2×280K5¼F	CP/M, BOS		●	I7	Top end business system
Jupiter Ace	£90	Z80	3.25	3K	51K	32×24	Tv(M+)		64×46	C		●					1	●			Fr		J1	Native Forth machine
Kalamazoo 1050	£3,450	8085	6	64K		80×24	Tv(M+)		80×24	W	10		1						2×250K5¼F	Kalamazoo		●	K3	Only Kabol language
Kemitron K2000E	£2,242	Z80	4	64K		80×24	(M+)		80×24	W			2	1			11		1×300K5¼F	CP/M		●	K4	Scientific Keyboard
Kemitron K3000	£3,795	Z80	4	64K	256K	80×24	(M+)		80×24	W		●	2				14		2×1Mb8F	CP/M, MP/M		●	K4	For scientific use
Kenilworth 83G	£1,953	Z80A	4	64K		80×25	TvM		160×75	W	10	●	1	1			5		2×350K5¼F	CP/M		●	K5	British portable
Kenilworth 83N	£2,012	Z80	4	64K		80×25	TvM		160×75	W	10	●	1	1			5		2×350K5¼F	CP/M	Ba	●	K5	Includes Basic
Kontron RSI 80	£3,306	Z80	4	64K	128K	80×25	M		256×512	W	16	●	2	1			8		2×303K5¼F	Kontron	Ba	●	K6	O/S CP/M based
LSI M3	£2,064	Z80	2.5	64K		80×24	M		80×24	W	31	●	1	1					2×200K5¼F	CP/M		●	L3	Big, British and CP/M
LSI M4	£2,472	8088	5	128K	256K	80×24	M		160×72	W	31	●	2	1			1		2×400K5¼F	CP/M 86, CP/M80		●	L3	Z80 for 8-bit software
Logica VTS Vitesse	£2,863	8086	5	64K	256K	80×24	M	●	640×288	W	12	●	1	1			4		2×1Mb5¼F	CP/M, MS-DOS	Ba	●	L4	High-res colour graphics
Marin Chip M9900	£5,750	9900	3	64K	1.6Mb	24×80	M		24×80	W	8	●	4				12		2×1.2Mb8F	MOS, MDEX	Ba	●	M2	Genuine 16-bit
Micro Five 1000	£5,175	8088	8	128K	512K	25×80	TvM		512×512	W	20	●	10				2		2×1Mb5¼F+2×6.3Mb5¼H	*		●	F2	*Choose your own O/S
Micro Five 3000	£10,350	8086	5	128K	1Mb	25×80	TvM		512×512	W	20	●	5				3	●	1×10Mb8F	*		●	F2	*Choose your own O/S
Microdecision	£1,144	Z80	4	64K		80×24	(M+)			*			2						1×200K5¼F	CP/M	Ba,Pilot	●	I2	*Terminal extra
Microsolution British Genius	£1,840	Z80	4	64K		80×24	TvM		80×24	W	21	●	1	1					2×160K5¼F	CP/M		●	M4	'Genius' by nature?
Millbank SX10	£2,754	Z80A	4	65K	256K	80×25	M		80×25	W	10	●	2			1			2×350K5¼F	CP/M	As	●	M5	Scientific applications
Molecular M200	£5,462	Z80	4	64K	320K		(M+)*			*			2			1	16		1×10Mb8H+1×500K8F	CP/M	BaAs	●	G2	*Terminal required
Monroe EC8800	£2,990	Z80A	3	128K		40×24	M		240×240	W	32	●	3			3			1×320K5¼F	Monroe	BaPaPilot	●	F3	Only 40-character screen
Monroe OC8810	£3,162	Z80A	3	128K		80×24	M		80×24	W	32	●	3			2	1		1×320K5¼F	Monroe	BaPa	●	F3	Bigger model available
Multitech MPFII	£299	6502	1.2	64K		40×24	Tv(M+)	●	280×192	C				1		1	1	●		Cassette	Ba	●	F4	Apple soft compatible
Nascom 2	£327	Z80A	4	2K	64K	16×48	Tv(M+)		48×96	W			1				4	●		NAS, SYS	BaAs	●	L5	Old reliable
Nascom 3	£549	Z80	4	48K		16×48	Tv(M+)		48×96	W			1				4	●		NAS, SYS	BaAs	●	L5	Fully expanded Nascom
NEC PC8000	£1,454	Z80	4	32K	64K	80×25	M	●	160×100	W	10	●	2	1					2×300K5¼F	CP/M, NEC, DOS	Ba	●	N1	Superb colour graphics
New Brain A	£269	Z80A	4	32K	512K	80×30	Tv(M+)		640×220	C			2				1	●		Cassette	Ba		G3	A lot of promise
North Star Advantage	£2,766	Z80	4	64K		80×24	M		640×240	W	15		1				6		2×360K5¼F	CP/M		●	T9	16-bit option
North Star Horizon	£2,294	Z80	4	64K	512K		*		*	*			2	1		1	9		2×360K5¼F	North Star DOS	Ba	●	T9	*Choose your own terminal
Olivetti M20D	£2,754	Z8000	3	160K	512K	80×25	M	●	512×256	W		●	1	1			5		2×320K5¼F	PCOS	Ba	●	B6	Real 16-bitter
Olympia Boss Model A	£2,645	Z80A	4	64K		80×28	M	●	80×28	W	10	●	1				4		2×140K5¼F	CP/M		●	O1	Useful 28 lines on screen
Onyx 5001 MU	£7,607	Z80A	4	128K	256K	*			*	*			5	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	*Terminal extra: other models
Oric 1	£100	6502A	1	16K	48K	40×28	Tv(M+)	●	240×200	C				1		1		●		Cassette	Ba		O2	Expects Delivery delays
Osborne 1	£1,581	Z80	4	64K		52×24	M		128×32	W	10	●	1		1				2×185K5¼F	CP/M	Ba	●	O3	Portable, includes software
Panasonic JD 800M	£3,795	8085A	4	60K		80×24	M		80×24	W	21	●	3						2×250K8F	CP/M	Ba	●	P1	Larger model costs £5,002
Pasca 640	£1,437	Z80A	4	64K		80×24	M			W		●	1	1					2×250K8F	CP/M		●	W1	Regular CP/M micro
Pascal Modular Microengine	£7,003	WD9000	2	128K		*	*		*	*			4				8		2×1.2Mb8F	UCSD-P	Pa	●	P2	*Terminal extra
Philips P3500	£3,000	Z80A	4	64K	320K	80×25	M			W	11	●	2						2×0.6Mb5¼F	Turbo-DOS	Co	●	P3	Fast O/S as standard
Positron 900	£1,259	6809	1	64K	256K	*	(M+)		*	*			4		1		3			O/S 9	Ba	●	P4	*You choose your terminal
Positron 9000	£2,134	6809	1	64K	256K	80×24	TvM	●	480×240	W	12	●	4		1		3			O/S 9	Ba	●	P4	Multi user version
Quantum 2000	£2,587	Z80A	4	64K	192K	80×25	M		160×75	W	18	●	1	1			5	●	3×860K5¼F	CP/M		●	Q1	Mono, low-res graphics
Rair Black Box Model 3/20S	£2,242	8085	5	64K	512K	80×24	(M+)			*			2				8		2×1Mb5¼F	CP/M	Ba	●	R1	*VDU extra: many versions
Rair Business Computer	£6,037	8088	5	256K	1Mb	80×25	M	●		W	10	●	2			4	8		1×19Mb5¼H+1×1Mb5¼F	CP/M, PCDOS	Ba	●	R1	Hybrid 8/16 bit
Racal 6000	£6,327	Z80	5	64K	256K	80×26	M		80×26	W	21	●	1	1					1×600K8F	CP/M		●	R2	CP/M languages available
Research Machines 380Z	£2,147	Z80A	4	32K	56K	40×24	Tv(M+)			W			1	1			4	●	2×144K5¼F	CP/M	Ba	●	R3	Widely used in schools
Research Machines Link 480Z	£650	Z80A	4	32K	256K	40×24	Tv(M+)			W	4		2	1		1	2	●		Cassette	Ba		R3	CP/Net version available
Sage II	£4,019	68000	8	128K	512K	*	(M+)		*	*			2	1	1				2×640K5¼F	UCSD-P System	BaAsPaFn	●	T10	*Terminal extra
Samurai	£3,214	8086	4.6	128K	768K	80×25	M	●	720×400	W		●	3	1			3		2×1.2Mb8F	MS DOS, CP/M 86		●	M6	High-res colour graphics
Sanyo MBC 1000	£1,195	Z80A	4	64K		80×25	M		80×25	W	17	●	1	1					1×320K5¼F	CP/M	Ba	●	L1	Standard CP/M model
Sanyo MBC 1250	£2,294	Z80	4	64K		80×40	M		640×400	W		●	1	1					2×640K5¼F	CP/M	Ba	●	L1	High-res graphics
Sanyo MBC 2000	£2,242	8085A	5	64K		80×24	M		80×24	W	24	●	2	1			2		2×328K5¼F	CP/M	Ba		L1	Big disc model costs £3,622
Sanyo MBC 4050	£2,817	8086	5	128K	512K	80×24	M		80×24	W			1	1					2×640K5¼F	CP/M 86	Ba	●	L1	Pseudo 16-bit
Seed System 1	£2,300	6800	2	32K	64K	80×24	M		80×24	W	3	●	2				8		2×160K5¼F	DOS 68 Flex	Ba	●	S3	Ageing business machine
Seed System 19	£2,600	6809	2	48K	1Mb	80×24	M			W	3	●	2				8		2×160K5¼F	OS-9		●	S3	Latest from Seed
Sharp MZ80A	£549	Z80	2	48K		40×25	M		80×50	W		●						●		Sharp Basic	Ba	●	S4	CP/M facility extra
Sharp MZ80B	£900	Z80A	4	64K		80×25	M		320×200	C	10	●						●		Sharp Basic	Ba	●	S4	Unusual keyboard

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display			Graphics	Keyboard			Interfaces built-in					Storage		Operating system	Languages inc	Other languages available	Distributor	Comments
						Max characters columns × lines	Method (at extra cost)	Colour capability	Max dot resolution	Type of keyboard	No. of function keys	Numeric pad	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others	No. of expansion slots	Cassette facility	Capacity per disk and disk size					
Sharp PC1251	£79.95	Cust.	.58	4.2K			LCD		24×1	C	18	●					1	●		Sharp Basic	Ba		S4	Pocket computer
Sharp PC1500	£170	Cust.	1.3	3.5K	11.5K	26×1	LCD		156×7	C	6	●	1	1			2	●		Cassette	Ba		S4	Optional 4-pen plotter
Sharp PC3201	£2,300	Z80A	2.6	64K	112K	80×25	M		160×50	W	10	●					5		2×500K5¼F	Sharp Basic	Ba	●	S4	Powerful Sharp Basic
Signet 10025	£1,599	Z80B	6	64K		80×24	M	●	512×512	W		●	2	1			1		2×200K5¼F	CP/M, Macnos		●	A6	Choice of keyboards
Sinclair ZX81	£50	Z80A	3.5	1K	16K	32×24	Tv		64×44	C							1	●		Cassette	Ba		S5	Sold a million
Sinclair Spectrum	£125	Z80A	3.5	16K	48K	32×24	Tv	●	256×192	C							1	●		Cassette	Ba	●	S5	Very popular home micro
Sirius I	£2,754	8088	5	128K	896K	80×25	M		800×400	W	7	●	2		1		4		2×600K5¼F	CP/M 86, MS/DOS	Ba	●	A7	IBM style
Sord M5	£218	Z80A	4	4K	16K	40×24	Tv(M+)	●	256×196	C				1		2		●		Cassette	Ba		S6	Japanese home computer
Sord M23	£1,932	Z80A	4	128K		80×25	M	●		W	14	●	2	1		2	3		2×330K5¼F	Sord O/S, SB80	BaPips	●	S6	CP/M compatible
Sord M23P	£2,369	Z80A	4	128K		80×25	Tv(M+)	●	640×200	W	14	●	2	1		2	2		2×290K3½F	Sord O/S, SB80	BaPips	●	S6	Complete with suitcase
Sord M223	£3,277	Z80	4	64K		80×25	M			W		●	2			4			2×350K5¼F	Sord O/S, SB80	BaPips	●	S6	Standard business machine
Sord M243	£5,842	Z80	4	192K		80×25	M	●	640×400	W	15	●	4	1		4			2×1Mb8F	Sord O/S, SB80	BaPips	●	S6	Large and powerful
SW Technical Products SO/9	£5,750	6809	2	256K	1.2Mb	80×24	M			W	15	●	1	1					2×1.5Mb5¼F	Flex, Uniflex		●	S7	Top end SWTP
Spectrum	£11,442	68000	8	256K	4Mb	*	(M+)		*	*			4				16		2×720K5¼F	Mirage	Ap	●	M1	*As terminal
Sundance I	£6,969	Z80A	4	64K	256K	132×24	M			W	4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Ordinary CP/M machine
Sundance II	£8,205	Z80A	4	128K	256K	132×24	M			W	4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Middle-range Sundance
Sundance 16	£10,480	Z8001	6	256K	1Mb	80×24	M			W		●	5	1				●	1×14Mb5¼H	BOS		●	T2	Tape backup for hard disc
Superbrain JR	£2,403	Z80	4	64K		80×24	M		560×240	W		●	1				1		2×160K5¼F	CP/M	Ba	●	I1	Bigger models available
Superstar	£6,296	Z80	4	64K		80×24	Tv(M+)		80×24				1	1			8		1×10Mb5¼H+1×400K5¼F	CP/M 80	Ba	●	B7	Includes hard disk
Tandberg EC10	£3,000	8080A	2	64K		80×25	M			W		●	7						1×250K8F	CP/M, TOS	Ba	●	T3	Very early machine
Tandy TRS-80 Model I	£199	Z80	1.7	16K	48K	64×16	Tv(M+)		128×48	W		●						●		TRS-DOS	Ba	●	T4	Old faithful
Tandy TRS-80 Model II	£1,999	Z80A	4	64K	256K	80×24	M		80×24	W	2	●	2	1					1×500K8F	TRS-DOS	Ba	●	T4	Big business machine
Tandy TRS-80 Model III	£1,699	Z80A	2	48K		64×16	M		128×48	W		●	1	1		1		●	2×184K5¼F	TRS-DOS	Ba	●	T4	Latest TRS80
Tandy TRS-80 Model 16	£4,199	68000	8	128K	512K	80×24	M			W	2	●	2	1					2×1.2Mb8F	TRS-DOS	BaAs		T4	True 16-bit
Tandy TRS-80 Colour Computer	£240	6809E	1	16K	32K	32×16	Tv	●	256×192	W			1					●		Cassette	Ba	●	T4	Very popular
Tandy TRS-80 Pocket Computer	£57	Cust.	1	1.9K		24×1	LCD		24×1	C	5	●						●		Cassette	Ba		T4	Single-line display
Tandy TRS-80 Pocket Computer 2	£179	Cust.	1.3	2.6K	16K	26×1	LCD		156×7	C	6	●						●		Cassette	Ba		T4	Plotter available
Televideo TS-80ZH	£4,533	Z80	4	64K		80×24	M		80×24	W	15	●	2			1			1×256K5¼F+1×7Mb5¼H	CP/M		●	C11	Recently upgraded
Televideo TS-800 Series	£1,495	Z80A	4	64K		80×24	M		80×24	W	15	●	2			1				CP/M		●	C11	Standard CP/M machine
Televideo TS 1602-C	£3,714	8088	5	128K	256K	80×24	M		576×424	W	15	●	2			1			2×256K5¼F	CP/M-86		●	C11	Graphics, but no colour
Texas Instruments TI-99/4A	£150	9900	3.5	16K	52K	32×24	Tv(M+)	●	256×192	W						2		●		DOS	Ba	●	T5	This has sprite graphics
TI System 200-250	£6,695	9900	4	64K		80×24	M		80×24	W	12	●	1						1×5Mb5¼H	UCSD-P, PX10		●	T5	Bigger version available
TMK 332	£2,242	8085A	5	64K		80×24	M		190×96	W	22	●	2	1					2×320K5¼F	CP/M	Ba	●	P5	*6502 I/O processor
Torch	£3,214	Z80*	4/2	96K		80×30	TvM	●	640×256	W	15	●	1	1		4		●	2×400K5¼F	CPN	Ba	●	T6	CP/M compatible
Toshiba T-100	£1,900	Z80A	4	64K	96K	80×25	TvM	●	640×200	W	8	●	1	1	1		2		2×256K5¼F	CP/M	Ba	●	O4	Pro test March 18
Toshiba T-200	£2,242	8085	2.6	64K		80×24	M		80×24	W	15	●	1		1				2×256K5¼F	CP/M	Ba	●	O4	Standard CP/M machine
Transam Truscan	£1,983	Z80A	4	64K		80×24	TvM		640×288	W		●	2	1		1	5		2×190K5¼F	CP/M		●	T7	S-100 machine
Transtec BC2	£1,949	Z80A	4	64K	256K	80×24	M		80×24	W	13	●	2	1			8		2×386K5¼F	CP/M		●	T8	Fully definable characters
Vector 4	£3,852	8088	5	128K	256K	80×24	M	●	640×312	W	15	●	1	1		1	2		2×630K5¼F	CP/M, CP/M 86	Ba	●	A4	8-bit and pseudo 16-bit
Victor 9000	£2,754	8088	5	128K	896K	80×25	M		800×400	W	7	●	2	1			4		2×600K5¼F	CP/M 86, MS-DOS	Ba	●	D8	Same as Sirius 1
Wilkes YD8110	£4,025	8086	5	128K	896K	80×24	M	●	960×624	W	21	●		1			6		2×1.2Mb8F	CP/M 86	Ba	●	W2	Standard CP/M machine
Xerox 820 Model II	£2,415	Z80A	4	64K		80×24	M		1024×512	W		●	2	2			2		2×160K5¼F	CP/M		●	R4	Powerful graphics
Zenith 120-22	£2,978	8088	5	128K	192K	80×25	M		640×225	W	18	●	2	1	1	1	5		2×320K5¼F	CP/M, MS-DOS, Z Basic		●	Z1	Graphics includes turtle
Zenith Z89-81	£1,668	Z80	2.5	48K	64K	80×24	M			W		●	2	1					1×100K5¼F	CP/M	Ba	●	Z1	Elderly CP/M machine
Zeus 4	£5,400	Z80	4	64K	320K	80×25	(M+)		80×25	W	11	●	10						1×6Mb5¼H+1×250K5¼F	CP/M, Muse	As	●	M5	Designed as multi-user

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Bob Maunder is co-author of 'The ZX80 Companion' and author of 'The ZX81 Companion'. He is a Senior Lecturer in Computer Science at Teesside Polytechnic, holds an MSc degree in Computer Science, and is a Member of the British Computer Society.

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Centronics 730-4 RS232 80/132 column printer, £220 ono. Phillips mini digital cassette 6Kbaud R/W, £70 ono. Both include manual. Tel: Ipswich 219661/225 E. Hoffman.

Spectrum 16K unused, still boxed and with keyboard overlay, £110. Tel: 01-733 0949 during daytime and 01-733 6469 evenings.

TI99/4A software modules, Attack £13.50, Munchman £14.50, Car Wars £13.50, Personel Reports £26, Video Chess £20, ext Basic £35. Tel: Lev Howlett, Blackpool 63459 after 5pm, p+p inclusive.

Atari 800 16K Basic, 410 recorder, manuals, joysticks, Star Raiders, Missile Commance, Pac Man, Centipedes and many other games. £395. Tel: Ashwell 2474 after 8pm.

VIC-20 8K RAM cartridge for sale, £35. Tel: Thetford 64851 after 6pm.

ZX81 + 16K RAM + printer. New, cost £130, accept £90 ono. Tel: Leamington Spa (0926) 27201 eve or weekend.

Commodore 64 and cassette and Commodore manual. Unused, £335. 27 Aberfeldy House, John Ruskin St, London SE5. Tel: 587-1601 after 7pm.

Spectrum original tapes sell £2.50 each or swop. Timegate Battle of Britain, Sorcerors Castle, Backgammon Rescue. Tel: Martin 01-904 9489

Atari 400, 48K (guaranteed) Basic + manuals, cassette deck, £135 of software, arcade, adventure, & others. Book + articles 2 joysticks, Le Stick. Worth over £510 new. Only £375 ono. Tel: 0702 559455 after 5pm, ask for Chris.

Vic 20 C2N cassette unit 8K RAM pack, The Count and Adventureland cartridges. Startrek. Vic Programmers Reference Guide and magazines, £250 ono. Tel: Rotherham 558017.

Philips G7000 videopac, one month old, fully boxed with instructions and four cartridges, Gunfighter, Munchkins, Cosmic Conflict and The Computer Programmer. Cost me £135, selling for £100 ono. Tel: (074) 59492 after 4.30pm.

Level IV Basic for TRS 80, Video Genie—renumber, clock, delay, mid, merge, defined functions, one keyword entry, byte saver, enhanced graphics. All on cassette with manuals. Cost £40, £15. Tel: 0494 28592.

UK101 8K, 1-2 MHz 300/600 baud, cased, new-monitor, toolkit, joysticks, mini EPROM board, programmable sound generator, assembler, disassembler, games inc Supertrek, lots more software, £100. Tel: Bradford 727635 after 5pm.

Nascom II 32K uncased with PSU and plenty of documentation and some games programs, graphics ROM, only £190 or offers. Tel: 01-550 8965.

VIC 20 and kit to use ordinary cassette player many listings. Bought 4/12/82, boxed £109 ono. Tel: 570-3564, 33 West Way, Heston, Middx, London TW5 0JD, buyer collects.

Acorn Atom 8K + 2K computer, factory built, PSU, all leads, Atomic Theory Manual, still boxed, hardly used, bargain at £99. Tel: Hornchurch 44879 or 01-261 5789 (day time).

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Wanted Sinclair ZX81 1K. Willing to swap for Grandstand television game (colour). Tel: 01-250 0663 ask for Denis (evenings).

Sharp MZ80K with 48K. Excellent condition, dust cover lots of software including Fortran, Pascal, Fig-Forth, Knight-Commander Basic and games, manuals etc. £260. Tel: 01-651 5405.

Tandy pocket computer TRS80 (similar to Sharp PC1211) plus printer cassette interface originally cost £200. Mint condition £80. Tel: Ongar 363947 (evenings, weekends).

Sharp MZ80K 48K RAM extended Basic, Fortran compiler, over £100, software includes Space Invaders, 3D-Maze, disassembler, Othello, Backgammon, only £325. Tel: Rotherhan 816681.

Sharp PC-1211 pocket computer with cassette interface. Basic language and 24 digit display with application and beginners textbooks plus software on tape, £50 ono. Tel: Durham 733480.

Vic 20 C2N cassette unit. 16K RAM pack, Voodoo Castle cartridge, books, excellent condition. £200 ono. Tel: 01-607 3877 evenings.

ZX81 Sinclair, 1K, five months old. Hardly used. With Basic manual and power supply. Only £30. Tel: Joe, Rainham (Essex) 20663 after 6pm.

BBC B with user guide, three months old, boxed and mint condition. £355. Tel: 01-653 2497 eves or weekend.

BBC software, swap Acornsoft, Salamander, Program Power, A & F, etc for other BBC software. Tel: 0604-712447.

Nascom 2, Microsoft Basic, 32K RAM RS232 interface plus PSU cased and ready to run, £195. Tel: Clevedon 878238.

Video Genie plus sound kit, standard and advanced teaching manuals and other TRS80 books, £99. Tel: 021-382 3712 after 6pm.

Apple II, disc drive with controller, Visicalc 3.3, Vistrend, TV modulator, manuals etc, little used, £1,000 ono. Tel: 060084-687.

Acorn Atom 12K RAM plus 16K ROM plus BBC board, all buffers and connectors, 5 amp PSU, lots of software, £200. Tel: 01-422 4573 eves and weekends.

Apple II plus parallel printer interface with cable, suits Epson MX80, £50. Tel: Farnborough (66) 23903.

Sharp PC-1211 pocket computer plus PC-122 printer, cassette interface, vgc, £90 ono. Peter Allnut, 27 Paul Street, Chippenham, Wilts.

Pet 2001 8K integral cassette and monitor, just serviced, excellent condition. Manuals, programs and PET/CBM users guide. Good buy at £200. Tel: 03542-3693 (Cambs).

TRS80 16K level II CTR 80 cassettes plus green monitor with numerous programs including statistics personal finance accounts, £250 ono. Tel: 01-377 4810 day, 01-850 2676. eves.

TRS 80 16K level II, only 6 months old, excellent condition, plus magazines and over £100 of quality software, only £225 ono. Tel: Poynton 875673 after 4.30pm.

UK 101 40K RAM, new monitor, EPROM board with toolkit Basic V, 48 x 32 screen, over 25 software cassettes. Will sell 32K RAM and enhancements separately, £225 ono. Tel: 051-638 6775.

Schools! Spectrum 48K score/filing programs for AAA 5 Star award scheme. 13 events, ages 12 to 20, 3 and 5 events totals £7. P Consterdine, 2 Ridgeway Avenue, Marford, Wrexham, Clwyd.

Wanted disk drive (pref 2nd hand) for use with BBC model B. Derby area. Tel: 0332-773865.

UK101 8K, cased, 1-2 MHz, new monitor, 300-600 Baud, over 100 programs, will sell for £100 ono, or swap for colour TV/printer. Tel: Martin, Orpington 72793.

FX-702P pocket computer plus printer plus cassette interface with all manuals, only 3 months old, as new. Only for £130. Call Mohammed, 01-578 3420 after 6 (leaving the country).

Meteor for Vic-20, machine code, hi-res colour graphics, sound and music. Dodge meteors while rescuing stranded spacemen, only £3.95. Send to James Joghson, 7 High Street, Starbeck, Harrogate, HG2 7HX.

Acorn Atom 12K RAM 12K ROM plus PP toolbox ROM. Four books, many cassettes including Galaxian, Missile Base, Snapper, Invaders etc. PSU and TV lead also included only £250. Gary Read, Upminister 24589.

ZX81 plus 16K DK'Tronics RAM pack plus 16 games: Inca Curse, Planet of Death, Fun to Learn, QS Scramble, Flight Simulation, 3D-Defender, and Monster Maze. Worth £160, sell for £55. Tel: 02222-615579.

BBC B 1.20P System, user guide, leads, software £385. Free delivery. Tel: 0473 53161 evenings or weekends.

PET 2001 8K integral cassette, green screen monitor. TIS manuals. Software includes Microchess, Invaders, Backgammon, Dodgems, etc. £250. Tel: Anstruther (Fife) 311181 evenings. Buyer collects.

Atari 800 going away soon. Need to sell all software. All software original. Please send sae for listing, or ring 01-948 6654 after 9pm. Mr Tan, 6 Thamesgate Close, Richmond, Surrey.

Atari 400, program recorder, joysticks, all manuals, leads, and PU PSU's. De-Re Atari, plus £175 worth of software. Will swap or sell for £296. Tel: 0443-450840.

Vic 20 16K. C2N cassette player, joystick, covers, 'O' level cassettes and over £100 software including many arcade games and books. Cost over £400, will sell for £210 ono. Tel: 021-458 7682 after 5pm.

Spectrum programs. Sell or swap, Invaders, Arcadia Chess, Adventure games, £2.50. Tel: Chorley Lancs 70816, Tony.

Vic 20 cassette unit, speech synthesiser, motherboard, Programmers Aid/Super Ex cartridges, 4 games cart £50 cassette games, dust cover £330 ono. Tel: 0920-3529.

Sharp PC1211 pocket computer plus CE122 interface and printer. Still new in cartons, £95 Mike. Tel: 0273-410025 9am-7pm.

Vic 20 3K expansion C2N cassette player complete with Voodoo Castle cartridge plus two game cassettes, two joysticks only two months old. Cost £225 will accept £150. Tel: 0707-268496.

PET 3032 with 4040 disk drive. Toolkit, soundbox, payroll program. Assembler. Many games, £950 ono. Tel: Ellis 01-549 3233 (Kingston).

Bargain Video Genie 16K sound unit fitted good condition, hardly used, some software sell for best offer over £100. Write to Mr R McBride, 35 Harris Terr, Mill of Mians, Dundee.

ZK81 1K RAM, new keyboard, all leads and manual. £30. Sanyo 5G cassette recorder works with ZX81 £25. Master-

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ing Machine Code on Your ZX81 book. £5. Tel: Frinton 2451.

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Exchange Intellivision console plus 7 cartridges (Soccer Auto Racing, Space Battle, Star Strike, Tron, Utopia, Tanks) for 48K Spectrum. Tel: Paul 01-606 8811 ext 100-103, 9.30 — 1 pm only, weekdays.

TI99/4A, extended Basic, cassette leads, good condition, all manuals, new £250. Sprites, 16 colour graphics, 16K usable RAM, expansion options. TV lead, takes any 2 cassettes, £210 ono. Tel: 01-388 4222 ext. 4027 days.

Sinclair ZX81 and 16K RAM with three tapes; Invaders, Scramble, Gulp. Leads, power pack and Basic manual. Excellent condition. Cost me £100, selling for £60. Tel: 021-426 3685 after 4.30 pm.

Apple II green monitor twin disk drives, numerical keyboard, language card, manuals, software all good condition. £950 ono. Tel: Romford 751796 anytime.

Scissy's Chess Computer System III. Mains powered with memory and rechargeable pack, only six months old, never used, still boxed. Swap Spectrum or Vic 20 or similar computer. Tel: 041-776 0921, can post.

ZX81 16K RAM. A few taped games. Cassette leads, manuals etc. £45 including insured post to buyer. Tel: Northwich (0606) 79616.

Atari 400, 16K, cassette recorder, Basic and manuals, many, many programs including several arcade games, superb graphic demos, educational, joysticks. Price £250 for quick sale. Tel: (0204) 655393 evenings or weekends. Could possibly deliver.

Sharp MZ80K includes various games and utilities Database Knight Commander etc. All manuals £325 available in Leics of London. Tel: 0572-57406.

48K Microtan system with Tangerine keyboard, PGM, ESC and programmer, clock. Games, utilities, Database, Finance, and TUG's Columbia word processor software. All manuals, newsletters, books etc. Offers to John McGregor. Tel: 021-744 3257 after 6.30pm.

Wanted colour RGB monitor. Good condition for use with BBC B. Also wanted Acornsoft or other finished with software, willing to pay £150 for monitor. Tel: 01-788 6993, 5-9pm.

Vic-20 cassette deck, super expander, joystick, 3K RAM expansion, toolkit, machine code monitor plus books and loads of programs including games cartridges. £250 ono. Tel: Fleet 20587 evenings.

Home energy audit: A rather splendid package for the BBC model B which asks questions about your house and helps you cut those fuel bills. Just £7.95. Chandler, 9 Appleton Fields, Bishops Stortford.

ZX81 1K plus cassette with ten games and 3 Sinclair programs magazines only 4 months old. Cost £57 sell for £30 ono. Tel: 01-297 7207 after 5 (Tamer Osman).

ZX81 plus 16K RAM, 4K graphics ROM, plus user-definable graphics RAM (2K) plus professional keyboard and case plus £50 programs. Worth £200, bargain for £130 ono. Tel: Cranleigh 272402.

Atari 400 48K typewriter keyboard cassette deck, 2 game controllers £150+ of games, £40+ manuals, all less than 3 months old, including Basic. Over £600 worth. £485 no offers. Tel: Stone 816053.

Teletype 33 KSR ex mainframe terminal. Mechanics just overhauld. No electronics. Buyer collects, £40. Tel: Basildon 44520.

Acetronic programmable TV game. As new, boxed. Everything from Space Invaders to Mastermind. Cost £170, am getting married so must sell, includes over 200 games variations, only £50. Tel: Camberley 64246.

Commodore PET 2001 with 58 cassettes and over 150 programs, sound included, only £190 ono. Tel: Shanklin IoW 6492 after 5pm.

Kilobaud, 80 Microcomputing, and other PC magazines available for sale, and wanted. Smith, 84 Edenfield Gardens, Worcester Park, Surrey KT4 7DY.

Vic 20 8K plus C2N cassette, with carrying case, and programmers aid, ROM with over a £100 worth of software. Offers of £330. Tel: 021-543 8666 evenings.

Portable computer. Dragon 32, many books and tapes plus free 1976 model. Opel Kadett, 56,000 miles, genuine bargain, £885 ono. Tel: 01-942 3262 (day) or 01-977 1496 (eves/weekends).

Vic 20, Mole Attack and Jupiter Lander game. Cartridges, cost £20 each, sale price £10. Cartridges arrived after sold Vic. For details tel: 05827 69152.

ZX81 plus 16K RAM. Game tape: Thor the Wall (Scramble/Breakout). All worth £100. New one year guarantee, only £80, bargain. Tel: 021-356 2288 after 4pm. H. Bhatt, Birmingham.

Vic 20 plus Super Hi-res Expander (3K), excellent condition, all leads and manuals, £100 ono. Mr. P. Watson, 27 Dundee Road, Hartlepool, Cleveland TS25 5DZ.

Four ZX Spectrum books. £12 ono, worth £25. Sell or swap Meteor Storm £3, Space Intruders £3, Nightflite £3, Escape £3, RS Software Games £3. Tel: Coatbridge 29808 (after 6pm).

Nascom 2 48K graphics, NAS-SYS 3 cased, Hobbit digital cassette drive, IMP printer, Sargon Chess, Zeap NAS-DIS Naspen. Much software magazines, books, spare tapes, complete working system, £550 ono. Tel: Colchester (0206) 841293.

Tandy Color Computer, 16K, excellent condition. Extended color Basic, EDTASM+ assembler editor with debug, joysticks, manuals, leads. Six months old, hardly used, £265 ono. Tel: Medway (0634) 407604 evenings or weekends.

Vic 20 3K RAM pack, £23. Rat race cartridge, £16.50. Missile Command, £5.50. Invader Fall, £5.50. Vic Asteroids, £5.50. 3D-Maze, £5.50. VicGammon, £5.50 P&P included. N. Bradshaw, 12 Rosegill, Albany, Washington, Tyne & Wear. Tel: 0632 460144.

Hewlett Packard 38E, Statistical calculator, +five function, LCD quartz, man's watch. Offers please. 01-997 3560, Steve. If I am not in please leave your telephone number and I will call you ASAP.

BBC micro Model A with 32K RAM. 9" monochrome monitor and cassette recorder, all leads included. Offers around £350. Tel: 01-581 4689 after 6pm.

Atari VCS, 20 cartridges, new joysticks, adaptor, cartridge rack and books. Cost well over £600, sell for £350 (will pay postage), will not split. Everything in original packing. Tel: 041-946 9110.

Vic 20 software. Swop Asteroids or Amok, will swop for Frogger, Arcadia, or any Bug-Byte games. Tel: Northampton 402750 after 6pm.

TRS-80, Level 2, 16K VDU, tape recorder, all leads, plugs, power supply, manuals, many books, plenty of software (Invaders, Pacman, Asteroids, Chess, etc), good condition, £250, genuine bargain. 01-346 0095 after 6pm.

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Hisoft are pleased to announce the availability of Hisoft Pascal 4 for the 48K ZX SPECTRUM.

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NOW you and your children can learn to program in an efficient and structured way by using Pascal, the favoured language in schools and universities.

NOW you can write games programs etc. which run as fast as you need them to without having to resort to assembler or machine code.

NOW you can use a language which requires minimal re-learning when you move from your SPECTRUM to another computer; Hisoft Pascal 4 has all the essential features of Standard Pascal as detailed in the Pascal User Manual and Report — by Kathleen Jensen and Niklaus Wirth, the man who designed Pascal.

Hisoft Pascal 4 is a professional piece of software designed by a team who have been writing Pascal compilers for many years — you will find it to be powerful, flexible and very easy to use.

To top it all, we are offering the package (which includes a 60 page manual), for a limited time, to 48K ZX SPECTRUM users at an INCREDIBLE price of: **ONLY £25 INCLUSIVE.**

We also have a powerful assembler, disassembler and debugger package called DEVPAC. This includes a fast assembler that allows conditional assembly and has many assembler commands, a labelling disassembler and a debugger which is very easy to use and has single step facility. The entire package comes with a forty page manual giving full details of the system and DEVPAC costs only £12.50 inclusive.

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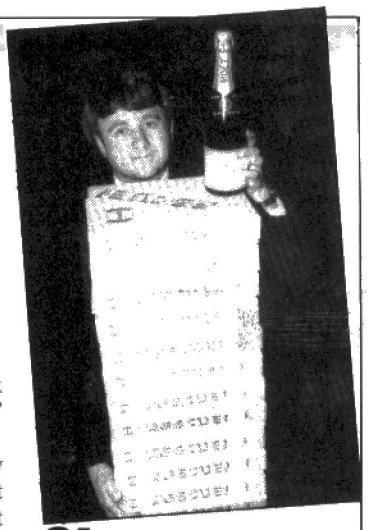
PAPERCHASE—finishing line



Bet you're dying to know what the paperchase proverb is . . . well . . . since the closing date was last Friday, April 8, we'll put you out of your misery.

It's: *Great oaks from little acorns grow.*

And, as many hundreds of you know, the missing word was, of course, 'acorn'.

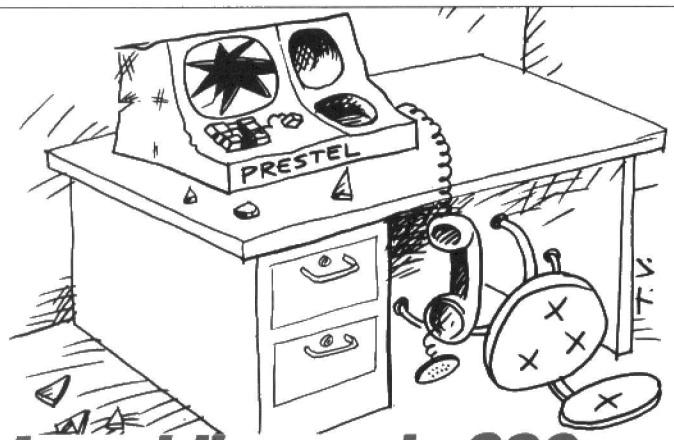
Clever stuff. However, due to overwhelming response from entrants who must have caused havoc in the home playing with little bits of paper, we haven't yet been able to draw the four winners.

So, sorry but suspense continues, at least till next week when we'll publish the winners' names.

Some of you have already telephoned the Oxford Street office to know the result. But don't waste your cash — we really won't let the secret out till we publish it next week.

Champagne feedback

We were not too sure whether you get a free bottle of champagne with every 12 copies of rescue or 12 copies of Rescue with every bottle of champagne. Life is never so simple. What you have to do is buy a copy of Rescue detabase package then send back a printout of your VDU's parameters. if yours is the lucky name drawn out of the hat you get the champers — a whole case of the stuff. The catch is that the package costs £340. Details from Microcomputer Business Systems on 01-253 3998.



Laughline—win £20

This cartoon was sent to us for publication. We all looked at it — 17 of us in *PCN*'s editorial office — and with the exception of a bit of bluffing from the more macho among us, none could see the joke. So we've decided to put it to the reader test.

And for incentive we're offering £20 to the wit who comes up with the funniest line. Funniest, that is as judged by the cartoonist and the editor.

Get your entries to us by April 29. Write them on a postcard putting Laughline in the top left-hand corner.

PCN DATELINES

PCN Datelines keeps you in touch with up-coming events. Make sure you enter them in your diary.

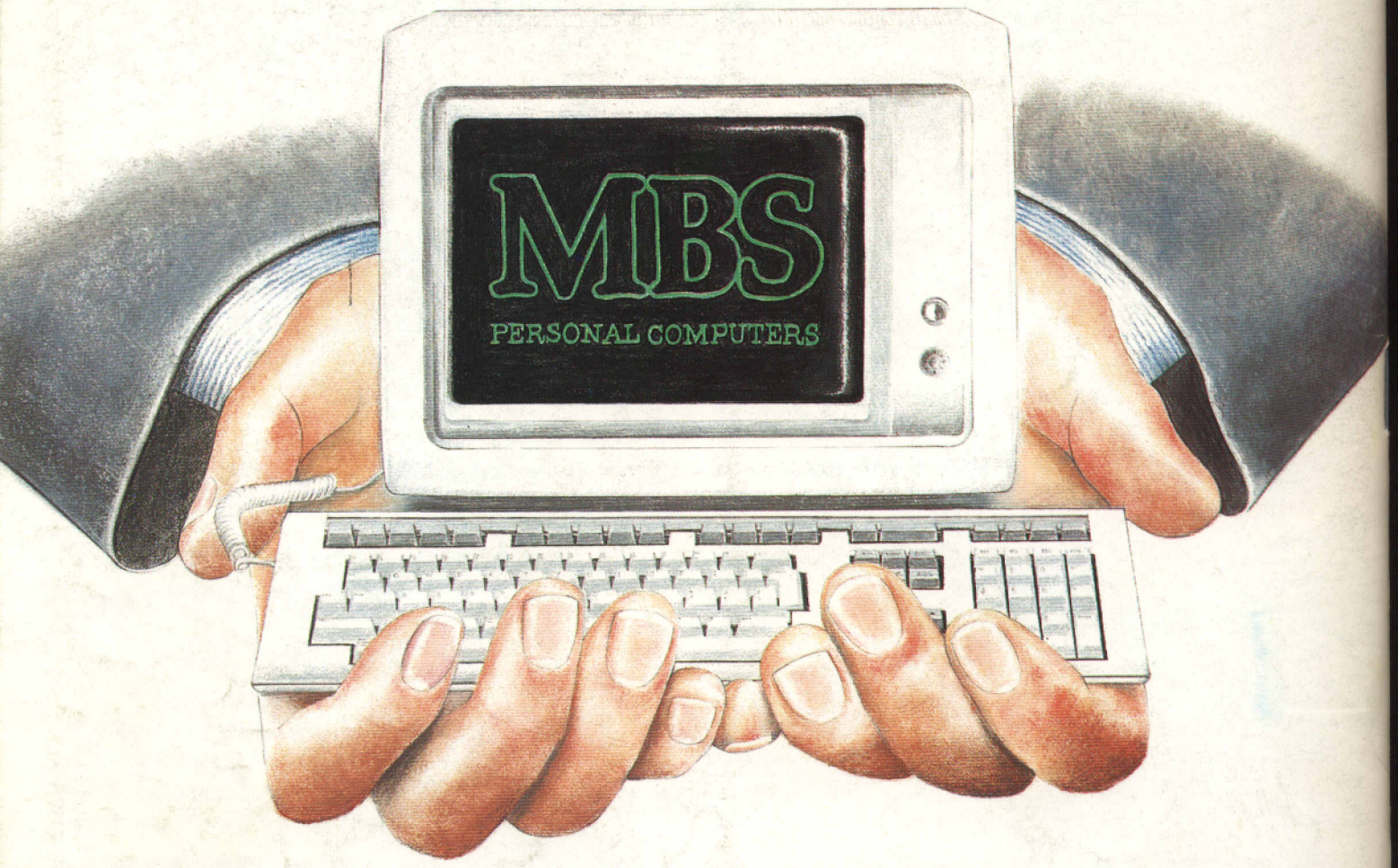
Organisers who would like details of coming events included in PCN Datelines should send the information at least one month before the event. Write to PCN Datelines, Personal Computer News, 62 Oxford Street, London W1A 2HG.

UK EVENTS

Event	Dates	Venue	Organisers
Computer Technology Exhibition	April 13-16	Recreation Centre, Newton Aycliffe, Co Durham	Jan Huntley, Sedgefield District Council, Spennymoor 816166
Computer Open Day Exhibition	April 14	Midland Hotel, Manchester	Tony Kaminiski, Couchmead Communications, 01-778 1102
4th London Computer Fair	April 14-16	Central Hall, Westminster, London	Sue Manning, ALCC, 01-226 9874
Manchester Home Computer Show	April 21-23	Midland Hotel, Manchester	Peter Freebrey, ASP Exhibitions, 01-437 1002
HP 1000 Users Exhibition & Conference	April 26-28	Heathrow Penta Hotel, London	Conference Services, 01-584 4226
Computer Trade Show	April 26-28	Wembley Conference Centre, Wembley	John Cole, Reed Exhibitions, 01-643 8040
Midland Computer Show	April 28-30	Bingley Hall, Birmingham	Roy Bratt, Reed Exhibitions, 01-643 8040
RIBA Computer Conference &	May 10-12	Bloomsbury Crest Hotel, London	Joe Hunting, RIBA Services Ltd, 01-637 8991
Micro City '83	May 10-12	Bristol Exhibition Complex	Stephen Hybs, Tomorrow's World Exhibition, 0272 292156
Computer Open Day Exhibition	May 12	The Post House, Southampton	Tony Kaminiski, Couchmead Communications, 01-778 1101
Compec Scotland	May 17-19	Kelvin Hall, Glasgow	Tracey Cannon, Reed Exhibitions, 01-643 8040

OVERSEAS EVENTS

Event	Dates	Venue	Organisers
International Computer, Computer & Robot Exhibition	April 14-20	Seoul, Korea	Korea Economic Daily, 441 Chungrimdong, Chung-ku, Seoul 100
Information Management Exhibition & Conference	April 26-28	McCormick Place, Chicago, USA	Tony May, Clapp & Poliak, 021-384 3384
Compec Europe Exhibition	May 3-5	Centre Rogier, Brussels	Tracey Cannon, IPC Exhibitions, 01-643 8040
National Computer Conference & Exhibition	May 16-19	Anaheim, USA	American Federation of Information Processing Societies, 1815 N Lynn Street, Arlington, VA 22209
Computers, Communications & Electronic Technology Exhibition & Conference	May 31-June 3	Melbourne, Australia	CETIA, PO Box 259, Roseville, Sydney, N S W 2069



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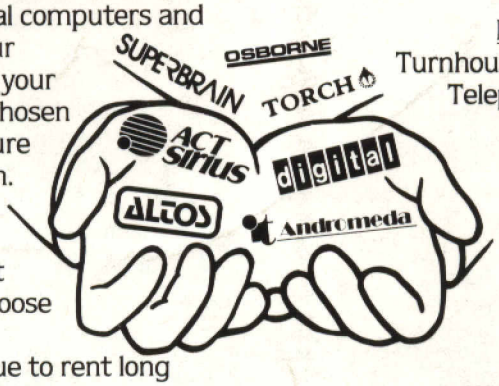

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